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O. P. BRYSCH, Editor

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1. GAS INDUSTRY

Atomic Power

Forbath, T. P. PROCESS FLOWSHEET—DEMONSTRATING COMMERCIAL ATOMIC POWER. *Chem. Eng. 64*, 230-33 (1957) August.

The EBWR at Argonne National Lab. now supplies 5000 kw of electrical energy for its laboratory. This nuclear reactor uses light water and operates its turbine on saturated steam at 600 psig. The reactor was designed for a maximum of operating conditions and experimental data.

W. G. Bair

Herron, D. B. and Puishes, A. THE PROSPECTS FOR ECONOMIC ATOMIC POWER. Amer. Soc. Mech. Eng. Paper No. 57-SA-25 San Francisco Conf. (1957) June 9-13.

The costs of generating electricity from nuclear energy are compared with those of conventional power plants. Typical busbar costs for conventional plants, in mils/kwhr are 7.3 in New York, 7.0 in Chicago and 5.0 in Dallas. Estimated generating costs for six nuclear plants under construction in the U. S. range from 10.5 to 17.9 mils/kwhr. Capital investments of these nuclear plants range from $233 to $540 per kw, while conventional plant is in the range $130-140 per kw. Areas of cost reduction for nuclear power equipment lie in 1) simplification 2) improved fuel fabrication 3) increase in heat transfer rate 4) higher burnup on fuel. Although not urgently required in the U. S., the critical foreign need of a new power source is an argument for continuation of the development programs of the U.S.

C. G. von Fredersdorff

Canadian Progress

Ebdon, J. F. TRANS-CANADA. THE STORY OF TURMOIL, TENACITY, AND TRIUMPH. *Gas 33*, 51-66, 115-140 (1957) August.

This eight-part article on the Trans-Canada pipeline includes an analysis of the major markets, an outline of the financing, sketches of the principal officers, a brief history of the development of Trans-Canada, the gas supply and gathering system, design considerations and the construction program. The design features give details of pipeline installations such as orifice metering, meter houses, drips, and mainline block-valve assemblies.

Quarles, W. R. TRANS-CANADA RUSHES 34-INCH LINE! *Pipe Line News 29*, 27, 28, 30-33 (1957) August.

During the 1956 season approximately 230 miles of the 34-inch section were completed. The remaining five sections, 354 miles of 34-inch and 85 miles of 30-inch, presently are under construction and are expected to be completed before the end of 1957.

Yorath, D. K. PIPE DREAMS BECOME REALITIES. *Gas 33*, 51-54, 112 (1957) September.

The Canadian natural gas reserves and markets, the pipeline builders' costs and budgets and expected growth tendencies are discussed.

Depletion Allowance

OIL AND GAS PRODUCERS FACE TAX FIGHT. *Gas Age 120*, 43-45, 53 (1957) August 22.

The cases for and against depletion allowances are presented. The controversy now rests in Congress. New impetus to cuts in tax concessions may come from expected subcommittee report.

Engineer Recruitment

Kubicek, E. C. EFFECTIVE RECRUITMENT OF GRADUATE ENGINEERS. *Chem. Processing 20*, 34, 35, 291-94 (1957) September.

In college recruitment frustration is brought about by lack of understanding of human motivation. Companies successful in college recruitment learned that consistency during "lean" as well as "fat" years in business is necessary. Interviewing companies must provide the placement office with descriptive literature in advance, and college or university placement offices cannot preselect graduates upon demand for company review. A salary scale must be competitive to sell a graduate on the company. Only by cooperative effort between graduate, college and industry can the need for qualified engineering personnel be fulfilled.

Gas Research

Johnson, G. B. HOW RESEARCH BENEFITS THE GAS UTILITIES. *Amer. Gas. J. 184*, 31-33 (1957) September.

Directly and indirectly, research has helped

save Minneapolis Gas Co. vast sums through lowered operating costs. Important A.G.A. research bulletins are reviewed and their applications to utilities service are discussed.

Gas Sales

Newberry, D. L. MARKETING IN THE NATURAL GAS INDUSTRY. *Gas 33*, 82-84 (1957) September.

Marketing, competition, sales programs and customer education are discussed for the natural gas industry.

Management

Allen, L. A. NEW CONCEPTS IN MANAGEMENT AND ORGANIZATION. *Gas 33*, 73, 74 (1957) August.

A brief discussion of the increasing need for improved internal efficiency to maintain gas industry profits and of the changes in management methods that are required to maintain efficiency as a company grows. G. G. Wilson

New Harris Bill

H.R. 8525 NATURAL GAS BILL SHELVED UNTIL 1958. *Gas Age 120*, 35-38, 40 (1957) August 22.

The new Harris Bill, introduced in the House July 5 and brought out of the House Commerce Committee on July 9 by a 15-13 vote, was shelved for this session of Congress by a decision made August 13 and announced by Speaker Rayburn. The bill is presented here in full.

Oil or Gas?

WILL OIL OR GAS WIN THE NORTHWEST. *Petrol Week 5*, 73, 74 (1957) September 13.

The promotional battle between oil, gas, and electricity for heating in Washington and Oregon is becoming more intense. Gas is gaining in industrial and new domestic construction markets.

Pipeline Economics

Lester, C. B. HYDRAULICS FOR PIPELINERS. PART 25. PIPELINE ECONOMICS. *Pipe Line News 29*, 20, 22-24, 26 (1957) August.

Pipeline economics do not differ from those of any other industry except in certain facets which are controlled by government laws. This article is concerned with peculiarities of pipeline economics and economic analyses used by operating companies.

Safety

Warner, W. E. EMERGENCY SHUTDOWN EQUIPMENT SAFEGUARDS COMPRESSOR STATIONS. *Oil Gas J. 55*, 96-98 (1957) August 12.

This article discusses safety devices developed and now used by the Natural Gas Pipeline Co. of America and the Texas Illinois pipeline systems. The first concern is for the safety of personnel. In case of a high-pressure accident, if the gas can be shut off and pressure relieved before fire, the relative damage may be inconsequential.

Solar Energy

Yellott, J. I. POWER FROM SOLAR ENERGY. *Trans. of the Amer. Soc. Mech. Eng. 79*, 1349-59 (1957) August; *Public Utilities Fortnightly 60*, 145-57 (1957) August 1.

Solar energy is needed to supplement fossil fuels and nuclear power. Nature of solar radiation, methods for estimating the amount available, flat-plate and concentrating collectors are discussed. Selective surface coatings, new tube-in-sheet materials, cycles, prime movers, need for water and high thermal efficiency are considered.

Suburban Markets

NEED FOR TWO-LEVEL ACTION STRESSED AT LOS ANGELES LPG APPLIANCE FORUM. *Butane-Propane News 19*, 25-28 (1957) August.

Another step toward a better understanding of LPG dealers by gas appliance manufacturers and of manufacturers by dealers was made at the second in a series of forums being arranged across the nation by *Butane-Propane News*. The Los Angeles forum brought forth fresh ideas for dealer-manufacturer cooperation in winning "The Battle of the Suburbs."

Author's Abstract

Venezuelan Oil

de la Cova, C. P. THE ECONOMIC AND STRATEGIC IMPORTANCE OF VENEZUELAN OIL TO THE UNITED STATES. *World Petrol. 28*, 70-73 (1957) July.

As the only country in the Western Hemisphere

with an oil surplus, Venezuela occupies a unique position in United States economic and military defense. Her general development based on oil has established a world wide example and enabled her to climb to immensely higher plateaus of economic progress. Author's Abstract

2. APPLIANCES

Air Conditioning

Bostick, O. STEAM TURBINES FOR AIR CONDITIONING. *Gas Age 120*, 20-24, 26, 57-59 (1957) July 11.

A detailed test and analysis of operating cost of a 309 hp steam turbine as a prime mover for a 320-ton centrifugal air-conditioning compressor was conducted at Georgia Baptist Hospital at Atlanta, Ga., for a three-year period.

Kuhlenschmidt, D. and Fowler, C. O. (assigned to Whirlpool-Seeger Corp.) INTAKE AND EXHAUST DAMPER CONTROL FOR AIR CONDITIONING APPARATUS. U. S. 2,801,-582 (1957) August 6.

This invention provides an improved air conditioning unit in which the means for admitting fresh air, exhausting stale air, and regulating recirculation of room air are operable from a common control element.

FLAME THAT FREEZES: PLUS AND MINUS. *Gas Age 120*, 17, 18 (1957) September 5.

Arkansas-Louisiana will continue manufacture of Servel All-Year Air Conditioning units. There are two problems facing the gas industry now: who will make gas refrigerators, and who will supply parts for repair and replacement of units in use.

MOST AIR-CONDITIONED AIRPORT. *Gas Age 120*, 22-24 (1957) September 5.

New Love Field Terminal at Dallas, to open Nov. 1, has complete year-round comfort thanks to gas. Annual load for Lone Star Gas will be 91,000 MCF, with peak in summer. Huge building is cooled by steam turbine driven refrigeration.

Water Heater

RHEEM'S HOLIDAY STORAGE WATER HEATER. *Appliance Mfr. 5*, 54-57 (1957) September.

A storage water heater which was "made to be seen." The Holiday heater which can feel at ease beside other modern appliances in kitchen or recreation room is described.

Clothes Dryer

Turner, C. C. WHY GAS CLOTHES DRYERS ARE YOUR BEST BUY. *LP-Gas 17*, 51-54 (1957) September.

When buying a clothes dryer, why settle for anything but the best? Your clothes dryer will give years of trouble-free service. An automatic gas clothes dryer alone will give the speed, flexibility and economy desired, and its basic principle of venting to the great out-of-doors is the only practical method of eliminating moisture in the home. Selected Extracts

Emergency Facilities

FOR MASS FEEDING IN EMERGENCIES. *Gas Age 120*, 14, 15 (1957) August 22.

Gas companies have facilities and know-how to care for communities in natural or man-made disasters. Utilities with LPG standby have special opportunity to originate or participate in mobile, all-gas self-sufficient kitchens.

Future Appliance Market

Martin, E. R. THE DUAL CHALLENGE FACING GAS APPLIANCES. TURBULENT TRANSITION LIES BETWEEN TODAY AND DYNAMIC 60'S. *Appliances Manufacturer 5*, 51-53 (1957) September.

There is hope for further large-scale additions to a list that A.G.A. has set as "potential," or realistic maximum sales attainable for the period 1955-74. The list itself is impressive: 94,185,000 gas ranges; 80,440,000 water heaters; 24,880,000 central heating units; 20,585,-000 gas floor and wall furnaces; 54,625,000 space heaters, 5,690,000 incinerators; 17,095,-000 clothes dryers. This estimate is achievable by the tremendous construction program of natural gas and swift growth of LP-gas use.

Heating Equipment

THE GAS HEAT DIRECTORY. *Gas Heat 8*, 89-133 (1957) August.

This 44-page directory consists of three main parts: an alphabetical list of all gas-fired equipment manufacturers; a second section or product directory; and a third section showing the trade names of gas heating products.

House-Heating

Blome, C. E. FACTS ON THE CLASS B VENT. *Gas Age 120*, 24, 29 (1957) September 5.

The Oil Heat Institute, through local chapters of its distribution division, is attempting to outlaw this vent. Such a program endangers the present and future of heating by gas. This article presents answers to erroneous claims demanding masonry chimneys in all new homes.

Clark, W. HEATING INSTALLATIONS UP 42% AS SEATTLE TURNS TO GAS. *Gas Heat 8*, 42, 43, 68 (1957) August.

Straight natural gas invades the Pacific Northwest where oil had garnered 85% of the market. In less than a year gas has made impressive gains, but as yet has only scratched the potential market.

A NEW CONCEPT FOR WARM AIR HEATING. *Appliance Mfr. 5* 77, 78, 80 (1957) September.

A gas furnace by Perfection Industries, division of Hupp Corp., Cleveland, Ohio has five major features: 1) appliance styling; 2) three stage firing; 3) air flow regulator system; 4) modular heat exchangers; and 5) reflective insulation.

Heat Pump

Fifield, H. G. (assigned to General Electric Co.) HEAT PUMP INCLUDING HOT GAS DEFROSTING MEANS. U. S. 2,801,524 (1957) August 6.

This invention relates to a heat pump including hot gas defrosting means and particularly to a heat pump including heat storage means for storing and supplying a substantial portion of the heat necessary for hot gas defrosting purposes.

Gray, J. (assigned to Brentford Electric Limited, England) HEAT PUMPS. U. S. 2,802,342 (1957) August 13.

Apparatus is claimed for utilizing the heat extracted from a refrigeration system to heat the water in the hot water system and to use similarly the heat produced by the motor and the compressor of the refrigerating system.

Young, H. H. A SATISFIED CUSTOMER REPORTS ON HIS HEAT PUMP. *Public Util. Fortnightly 60*, 309-12 (1957) August 29.

A report of a house-owner's experiences with a heat pump and an all-electric kitchen and laundry. Breakdown of kw hours is given, but no costs are reported.

Incinerators

Sheridan, F. A. 8 WAYS TO SELL INCINERATORS. *Gas Age 120*, 22, 24, 53, 54 (1957) August 22.

The following major buying appeals of gas incinerators are listed and discussed: sanitation, health, convenience, economy, fire prevention, home beauty, civic pride, and complete modernity.

Refrigerant Studies

Whitesel, H. A. CAPILLARY TWO-PHASE FLOW. PART 1 *Refrigerating Eng. 65*, 42-44, 98, 99 (1957) April: PART 2. *Ibid.* 35-40 September.

This paper first takes up the development of the Refrigerant 22 two-phase flow formula in a manner similar to that presented for Refrigerant 12 previously. These two formulas apply either when the entering fluid is a saturated liquid or when it is a combination of gas and liquid. In both cases, new gas is formed due to drop in pressure when the fluid starts to travel along the capillary. Adiabatic flow is assumed.

RATES OF THERMAL DECOMPOSITION OF $CHClF_2$ AND CF_2Cl_2. *Refrigerating Eng. 65*, 33-35 (1957) September.

Thermal decomposition rates of $CHClF_2$ and CF_2Cl_2 (Refrigerants 22 and 12) were measured from 175° to 570° C in a reaction cell of quartz glass with continuous analysis of the decomposing gas made by the mass spectrometer. Various materials which may be present in a refrigeration system were put into the cell, and the decomposition rates as affected by these were measured.

Refrigeration

Harris, W. S. CHILLED WATER HOUSE COOLING. A RESEARCH EXPERIMENT TO LINK SUMMER COMFORT WITH PRESENTLY INSTALLED HEATING SYSTEMS. *Refrigerating Eng. 65*, 48-54, 78, 80, 82 (1957)

The objective of this research on chilled water

(started at the Univ. of Ill., 1953) was to provide summer comfort in homes having steam or hot water heating systems. Tests to date have been exploratory, revealing the general operating characteristics of possible systems and their potentialities for development into residential cooling systems.

Nussbaum, O. J. AUTOMATIC DEFROST UTILIZING A LATENT HEAT SOURCE. *Refrigerating Eng. 65*, 33-36 (1957) July.

The art of low-temperature refrigeration has made significant progress by the introduction of latent heat as a heat source for defrost. The advantages are outlined which are not provided by other methods of low-temperature refrigeration. G. Matus

Space Heaters

Costello, T. J. and Costello, G. T. (assigned to National Heater Company, Inc.) SPACE HEATER. U. S. 2,800,126 (1957) July 23.

A high capacity, hot-air, space heater, with blown-air transverse flow around a cylindrical combustion chamber and upward over a tube-chest is claimed.

Garner, P. FOR REPLACEMENT UNIT SALES, SELL A SERVICE. *Gas Heat 8*, 34, 35, 72 (1957) September.

Instead of pushing sales, Republic Heating Co. of Chicago promotes a specific service and finds its methods pay off at the rate of one to three—a replacement unit sale for every three service jobs.

Lowe, F. J. CONVERSION BURNER OR DESIGNED EQUIPMENT. *Gas Heat 8*, 31, 32, 73 (1957) September.

Users of gas heating equipment favor conversion burners over designed boilers by approximately three to one. This ratio does not apply for sales of the last few years, but represents the overall picture of equipment now in use.

3. COMBUSTION AND INDUSTRIAL FURNACES

Air Pollution

Jarvis, W. D. and Austin, L. G. ROUTINE SURVEYS OF ATMOSPHERIC POLLUTION BY DUST AND SULFUR DIOXIDE AROUND POWER STATIONS OF THE CENTRAL ELECTRICITY AUTHORITY. *J. Inst. Fuel 30*, 435-46 (1957) August.

Atmospheric pollution surveys carried out by the Central Electricity Authority show that increase in dust deposition within two miles of a power station is small. Average concentration of SO_2 at ground level has shown a small increase with increasing power station output, but changes in the levels of SO_2 during the surveys do not allow a significant conclusion. Other methods of measuring small changes in the concentration of SO_2 should be considered.

Lunche, R. G., Stein, A., Seymour, C. J. and Weimer, R. L. DISTRIBUTION SURVEY OF PRODUCTS EMITTING ORGANIC VAPORS IN LOS ANGELES COUNTY. *Chem. Eng. Progress 53*, 371-76 (1957) August.

Organic-solvent usage in Los Angeles County approaching 600 tons daily has been revealed. Only about 400 of the 600 tons are vaporized. The authors state that control may be achieved by adaptation of disposal equipment, reformulation of solvent-containing products so as to eliminate the solvents, and development of new techniques in surface-coating operations.

Sittenfield, M. CHEMICAL ENGINEERING ASPECTS OF AIR POLLUTION CONTROL. *Chem. Eng. Progress 53*, 366-70 (1957) August.

Chemical engineering in air pollution control and measurement is discussed. The cost of equipment and of process operations is of prime concern to the chemical engineer who has the responsibility for the elimination not only of industrial air pollution, but also of that arising from the daily activity of all people.

von Bergen, J. LATEST METHODS YOU CAN USE FOR INDUSTRIAL ODOR CONTROL. *Chem. Eng. 64*, 239-50 (1957) August.

Odors from chemical plants can be psychologically dangerous. The following odor control methods are described: 1) combustion—catalysts used to complete combustion; 2) adsorption—activated carbon adsorbs odors; 3) absorption—used when odorous vapors are emulsifiable in a liquid; 4) odor masking—another odor is superimposed creating a pleasant sensation; and 5) odor counteraction—particularly

effective against multiple odor sources. Air pollution control methods for odor have proved successful, but each problem is specific and unusual. Air Pollution Control Assoc. in Pittsburgh accumulates and disseminates information regarding air pollution control.

LOS ANGELES TURNS TO INDUSTRIAL ZONING. *Petrol. Refiner 36*, 230, 32, 34 (1957) August.

To prevent growth from adding to the already man-sized air pollution problem, Los Angeles officials have begun to design a planning and zoning program that will permit location of potential sources of air pollution in areas where they will least contribute to the smog problem.

Burners

Nesbitt, C. W. (assigned to Modine Manufacturing Co.) AN ADJUSTMENT FOR GAS BURNER MANIFOLD. U. S. 2,803,294 (1957) August 20.

In a cased, unit heater appliance heated by one or more gas burners, a combination burner manifold and air inspirator is claimed which includes the usual, slidable-disc air port mounted to be accessible from outside the appliance.

Young, C. C. COMBUSTION HEAD FOR BURNER APPARATUS. U. S. 2,803,296 (1957) August 20.

In an oil or a combination gas-oil burner, several vanes extending radially from the oil nozzle tube are mounted within an enclosing guide tube to direct the air-gas mixture axially around the oil-kindling zone.

JET BURNER HEATING. *Gas J.* (British) *291*, 223-25 (1957) July 31; *Gas Times* (British) *91*, 382, 83 (1957) July 19; *Industrial Gas 20*, 16, 18-20, 22-24 (1957) August.

This article outlines the work of the North Eastern Gas Board in the jet (tunnel) burner field and gives details of the burners listed.

Combustion Efficiency

Richmond, K. C. COMPARATIVE EFFICIENCIES FUEL AND EQUIPMENT. *Coal-Heat 73*, 13-24 (1957) August.

This is the third article in a series of detailed question and answer memos concerning comparative fuel efficiencies for various building and plant owners, school, hospital and institutional board members, architects, builders and engineers.

Schuster, F. UEBER DIE ANWENDUNGSGRENZEN VON VERBRENNUNGSDIAGRAMMEN (ABOUT THE RANGE OF APPLICATION OF COMBUSTION DIAGRAMS). *Brennstoff- Chemie* (German) *38*, 246-49 (1957) August 14.

The occurance of H_2 and carbon oxides in an incomplete combustion can be brought in agreement with the Ostwald's combustion triangle which in its basic form considers carbon oxides only. G. Matus

Ulrich, R. COMBUSTION TESTING. PART 1. *Gas Heat 8*, 25-27 (1957) July; PART 2. *Ibid.* 38, 39, 86 August; PART 3. *Ibid.* 36, 39, 40 September.

Combustion testing on the job to get full advantage of the flexibility of the atmospheric injection burner under diverse operating conditions is discussed. Typical codes and municipal ordinances requiring such tests are listed, with explanations of what combustion tests show and how burners can be adjusted to produce acceptable test results. The second article discusses the operation and adjustment of the neutral pressure point, testing for and adjusting of CO_2 in flue products, and the meaning of percent combustion efficiency. CO in combustion products, its elimination and the adjustment of gas input and gas pressure for proper combustion comprise the concluding article.

Detonation Mechanism

Nicholls, J. A., Wilkinson, H. R. and Morrison, R. B. INTERMITTENT DETONATION AS A THRUST-PRODUCING MECHANISM. *Jet Propulsion 27*, 534-41 (1957) May.

A reaction device operating on intermittent gaseous detonation waves is considered. A simplified theoretical analysis is presented and discussed. A cyclic detonation tube was designed and operated utilizing hydrogen-air mixtures.

Flame Research

Bailey, J. J. A TYPE OF FLAME-EXCITED

OSCILLATION IN A TUBE. *J. Appl. Mech. 24,* 333-39 (1957) September.

Propane-air mixtures were burned in an open-end tube containing a screen flame-holder. Two types of instability were observed. One is described and a driving mechanism is proposed and examined in the light of Rayleigh's criterion. Finally, a linear, one-dimensional theory is presented,to account for both the driving and damping effects in the system. The predictions are shown to be in good agreement with the experimental results.

Fine, B. STABILITY LIMITS AND BURNING VELOCITIES FOR SOME LAMINAR AND TURBULENT PROPANE AND HYDROGEN FLAMES AT REDUCED PRESSURE. Nat. Advis. Comm. for Aeronautics. Tech. Note 4031 (1957) August.

The stability behavior is reported for the propane-oxygen-nitrogen, hydrogen-argon-"air," and hydrogen-helium-"air" burner flames which covers flashback reactivity, pressure exponents of burning velocity, and critical boundary velocity gradients for laminar and turbulent flashback and blowoff.

Gasifier for Turbines

Walter, L. EUROPE LIKES FREE-PISTON TURBINE DRIVES. *Petrol. Refiner 36,* 127-32 (1957) August.

The use of free-piston engines is rising in European operations. Design considerations for their use in refineries and petrochemical plants are presented.

A BRITISH BUILT FREE-PISTON GASIFIER. *Gas and Oil Power* (British) *53,* 180-83 (1957) August.

The first British-built free-piston gasifier ran trials at the Ashton-under Lyne works of the National Gas and Oil Engine Co. Ltd. Only nine months elapsed since the signing of a license agreement. The Brush Electrical Engineering Co. Ltd. has designed a range of gas turbines specifically for use with single or multiple-unit gasifiers. These cover outputs from 1,000 to 10,000 hp in 12 frame sizes with from five to eight stages and rotor speeds of from 12,750-3,000 rpm.

Grain Driers

Reeds, M. J. COKE-FIRED GRAIN DRIERS. *Coke and Gas* (British) *19,* 329-43 (1957) August.

Advances in grain drying techniques make possible the harvesting of very damp grain. The original air driers of the continuous and batch types offer positive means of drying down to a predetermined moisture content. Three types of grain drying furnaces using coke are described: hopper type gravity feed; semi-producer furnaces, wet and dry grate; and hand fired flat grate.

Industrial Heating

Smith, A. Q. HEAT TREATING ASSURES STRENGTH OF ARMY TANKS. *Indust. Gas 36,* 2 ,3 (1957) August; GOOD HOUSEKEEPING IS EVIDENT IN KORTICK FORGE SHOP. *Ibid.* 4-6; HOW PAN AMERICAN GUARDS SAFE FLIGHTS. *Ibid.* 7-9; GAS: QUALITY FUEL FOR QUALITY BRONZE BEARING. *Ibid.* 10-11; WEST'S LARGEST CEMENT PLANT PREFERS GAS FOR FUEL. *Ibid.* 12-14; DRYING OPERATION SPEEDED BY RADIANT BURNERS. *Ibid.* 15, 16.

This series of articles describes and illustrates some basic industries in the San Francisco Bay area which depend upon natural gas for specialized heating applications. These include the heat treating of army tank parts, forging furnaces for pole line hardware, heating ovens for airplane engine overhaul, melting furnaces for bronze bearing manufacture, cement kiln-firing, and paper product drying.

GAS IN THE MANUFACTURE OF PIPES AND TUBES. *Industrial Gas* (British) *20,* 12-15 (1957) August.

The Yorkshire Copper Works Ltd. manufacturers of copper tubing and fittings, is the largest single consumer of gas in the North Eastern Gas Board's area. Gas consumption has grown from 116,250,000 CF in 1948 to 437,567,000 CF in 1956. The use of town gas in steel pipe manufacture by Clayton, Son and Co. Ltd. for welding the longitudinal seams of steel pipes uses the "water-gas roller welding process." North Eastern Gas high intensity gas burners per-

mitted the use of town gas for welding by the substitution of coal gas for water gas.

Metallurgical Furnace

Bates, J. P. and Turner, C. A. Jr. GAS-AIR FLAME HARDENING INCREASES GEAR STRENGTH. *Ind. Heating 24*, 1526-28, 30, 32, 34 (1957) August.

Flame hardening of carbon steel for high hardness at the tooth surface, while maintaining core toughness of gears was undertaken by Hyster Co. and Selas Corp. The Selas unit of Duradiant air-gas burners gives rapid combustion of premixed gas and air within confined burner cups and rapid heat transfer to work by radiation and by convected heat.

Cullen, O. E. METHODS OF CONTROLLING ATMOSPHERES IN FURNACES. *Ind. Heating 24*, 1510-12, 14, 19-22, 34 (1957) August.

Emphasis is placed on automatic functioning of equipment and in establishing furnace design and operating technique to utilize automatic control equipment to full advantage, including details on direct control of furnace atmospheres.

Harper, R. L. FURNACE SINTERING OF METALS AND CERAMICS. *Metal Progress 72*, 69-72 (1957) August.

Brief discussions on temperatures, times and atmospheres are presented for the well-known powders, plus remarks on reasons for vacuum sintering, the handling of mixtures for magnets and electronic "ferrites," as well as the metallizing of ceramic bodies so that connections can be welded or soldered.

Koebel, N. K. FURNACES FOR SINTERING AND HEAT TREATING POWDER METAL PARTS. *Metal Progress 72*, 65-68 (1957) August.

Furnaces for sintering powder metal parts may be mesh-belt, roller-hearth or mechanical pusher type, depending on requirements. The batch-type vertical radiant tube furnace is particularly suited for hardening sintered iron and steel parts in controlled atmospheres.

Superpressure Steam

Campbell, C. B., Franck, C. C. Sr. and Spahr, J. C. THE EDDYSTONE SUPERPRESSURE UNIT. *Trans. Amer. Soc. Mech. Eng. 79*, 1431-56 (1957) August.

Philadelphia Electric Co. presents a new Eddystone Station development of the steam-power plant of the future. This turbine is rated at 325,000 kw and is designed for inlet steam conditions of 5015 psia at 1200° F with two stages of reheat to 1050° F. It will exhaust at one in. Hg. absolute. Eight extraction stages actually are used.

Weather vs. Consumption

Crow, L. W. CAN WE PIN-POINT DEGREE-DAYS? *Fuel oil and Heat 16*, 75-77, 149 (1957) September.

This article suggests some refinements of the degree-day approximation technique which will bring the calculated values of fuel oil consumption closer to the actual values.

4. GASIFICATION AND CARBONIZATION

Carbonizing Plant

NEW "REXCO" CARBONIZING PLANT AT THORESBY COLLIERY. *Gas World* (British) *146*, 44, 46, 48, 50 (1957) August 3.

Thoresby Colliery, Edwinstowe, recently opened a new Rexco smokeless fuel plant. Non-caking or weakly caking coal in lump form is heated to a temperature of 700-800° C to form a highly reactive char. Each retort is plate-shell, lined with fire-brick, 10 ft. diam. by 25 ft. high, and treats 350 tons/day.

Coal Constitution

Bergmann, G., Huck, G., Karweil, J. and Luther, H. ULTRAROTSPEKTREN VON STEINKOHLEN (INFRARED SPECTRA OF BITUMINOUS COAL). *Brennstoff-Chemie* (German) *38*, 193-99 (1957) July 17.

The infrared spectra of coal of various origins and with different degrees of coalification were inspected. The individual bands are discussed, and the spectra of thermally treated as well as oxidized coal were measured. To obtain more information about the kind of bituminous constituents of the coal, the products of distillation in high vacuum were analyzed. G. Matus

Kroeger, C. and Kuthe, F. DIE PHYSIKALISCHEN UND CHEMISCHEN EIGENSCHAFTEN DER STEINKOHLENGEFUGEBESTANDTEILE (MACERALE). VI. AUSBRINGEN VON KOKS UND KOHLENWERTSTOFFEN BEI DER VERKOKUNG. (THE PHYSICAL AND CHEMICAL PROPERTIES OF THE STRUCTURAL CONSTITUENTS OF COAL (MACERALS). VI. OBTAINING COKE AND COAL CHEMICALS BY CARBONIZATION). *Brennstoff-Chemie* (German) *38*, 200-08 (1957) July 17.

The production of coke and hydrocarbons from the structural constituents of bright and dull coal layers was determined in an improved Bauer apparatus under constant conditions. The results depend on the elementary composition of the constituents and the coking conditions. Also the chemical structure influenced somewhat the yields of water, CO_2 and CO. Tar yield depended upon hydrogen content; benzol, gas, heavy hydrocarbons and methane upon H/C ratio. The amount of hydrogen obtained depends only on the coking conditions.

G. Matus

Coal Gasification

Grossman, P. R. and Sprague, T. S. (assigned to The Babcock & Wilcox Co.) METHOD OF AND APPARATUS FOR GASIFICATION OF PULVERIZED COAL. U. S. 2,801,158 (1957) July 30.

A complete gasification apparatus is claimed which comprises a lower cylindrical primary zone, a superimposed secondary zone with a separating constricted outlet between, in which suspended solid fuel injected downward with steam and oxygen into the lower zone is gasified and releases its slag on the lowest walls in an impinging flame so as to drain downward readily.

Just, H. PROCESS FOR PREVENTING OR REDUCING THE ENTRAINMENT OF FINE SOLID PARTICLES IN THE GAS STREAM OF A GAS PRODUCER. U. S. 2,799,565 (1957) July.

The entrainment of fine dust particles in the product gas stream moving up through a coal bed of a gas producer is reduced by coating a layer of the bed with a hydrocarbon containing a moistening agent such as tar, oil residue, pitch or similar substances. The sticky layer which then is formed filters out the dust in the gas.

E. J. Pyrcioch

Ludeman, C. G. (assigned to Texaco Development Corp.) METHOD OF PREPARATION AND CONVERSION OF SYNTHESIS GAS. U. S. 2,800,402 (1957) July 23.

A process is claimed for the preparation of CO wherein a carbonaceous fuel is reacted with free oxygen for partial combustion at temperatures about 1600°F forming a product gas relatively free from CO_2 and water vapor. The improvement is the addition to the product gas, CO_2 and water vapor in amount to at least 20% of the total product gas.

Ludeman, C. G. (assigned to Texaco Development) PROCESS FOR THE PRODUCTION OF CO FROM A SOLID FUEL. U. S. 2,803,530 (1957) August 30.

Solid fuel is gasified in a fluidized bed with O_2 and steam at 1800°F, with the particles below 200-mesh entrained in the product gases retained to react further at 2200° F in a separate zone.

Wagener, D. GEDANKEN ZUR WIRTSCHAFTLICHKEIT DER SCHWACHGASERZEUGUNG. I. VERFAHRENSARTEN, GRUNDLAGEN UND ERGEBNISSE DER WIRTSCHKEITSBERECHNUNG. (OPINIONS ON THE ECONOMICS OF LEAN GAS PRODUCTION. I. PROCESSES, BASIS AND RESULTS OF ECONOMIC CALCULATIONS). *Erdoel u. Kohle* (German) *10*, 430-33 (1957) July; II. KOPPELVERFAHREN: VERGLEICH DER WIRTSCHAFTLICHKEITSBERECHNUNG MIT BETRIEBSERGEBNISSEN (II. LINKED PROCESSES: COMPARISION OF ECONOMIC CALCULATION WITH OPERATION RESULTS). *Ibid.* 513-15 August.

This investigation discusses how the different variables influence the economy of fixed bed, fluid bed and dust suspension gasifying operations. Secondly, the results of the investigation are proved on the basis of data from know installations. Linked or associated processes, such as production of steam, oil and tar, and

pig iron are discussed in Part II with regard to their influence on economics of lean gas production. G. Matus

Coal Pyrolysis

Prien, C. H. PYROLYSIS OF COAL AND SHALE: UNIT PROCESSES REVIEW. *Ind. Eng. Chem. 49,* 1548-52 (1957) September, Part 2.

Low temperature carbonization continues to be the most active field of coal pyrolysis. Fundamental studies include reactions in the plastic region, and compounds analogous to coals in pyrolytic behavior. Activity in development of oil shale resources has increased, with private industry moving rapidly into the field.

Coke Oven Wall Pressures

Lambert, J. L., Lancucki-Pater, W. J. and Lee, G. W. EXPERIMENTS CONCERNING THE EFFECT OF COKING PRESSURE IN FULL SCALE OPERATION OF COKE OVEN PLANT. *J. Inst. Fuel* (British) *198,* 362-86 (1957) July; *Gas World* (British) *146,* 5-24, 31 (1957) July 6.

The strength of a coke-oven wall under conditions of normal operation has not been known exactly. Experience in using the British Coke Research Assoc.'s movable-wall test oven indicates that the prepared coal should show a maximum pressure below two lb/in^2 to avoid wall damage. Recent paired experiments on full-scale coke ovens by the Guest Keen Iron and Steel Co. Ltd. and on the experimental oven were made on a selected series of coals. The authors describe the increasing pressures and damage, and demonstrate the correlations between the results, which bear out the safe practical working limit of two lb/in^2 for coking pressures.

Hydrocarbon Gasification

Carton, P. and Gosselin, A. H. (assigned to Soc. Chim. de la Grande Paroisse Azote et Produits Chimiques, Paris) METHODS FOR THE CATALYTIC DECOMPOSITION OF HYROCARBONS BY STEAM. U. S. 2,801,159 (1957) July 30.

Carbon formation is eliminated in a zircon-magesium catalyzed pyrolysis of heavy hydrocarbon-steam mixtures by preheating a primary stream of the mixture to 450°C subdividing this and injecting aliquots at several successive points into the remaining gas stream heated to 850° C.

Kappel, V. V. ENDOTHERMIC GAS GENERATOR. U. S. 2,802,725 (1957) August 13.

This claims an endothermic gas generator for producing a special gaseous atmosphere, comprising a heated chamber which supplies a gas mixture under pressure to a catalytic chamber in the heating chamber. An elongate coil then receives the generated gases at high temperature. A second catalytic chamber at the other end of the coil completes the decomposition.

Lawton, E. J. THE MANUFACTURE OF TOWN GAS FROM LIQUID OR GASEOUS FUELS. *Gas J.* (British) *291,* 181, 82, 86, 87, 90 (1957) July 24.

Present world fuel production data indicate a trend to oil for gas making. Current supplies show the advisability of installing gasification processes sufficiently flexible to handle as feedstocks the most advantageous and available petroleum fraction. Oil cracking, thermal and catalytic gasification processes and operating data are reviewed.

Pettyjohn, E. S. and Linden, H. R. (assigned to The Institute of Gas Technology.) APPARATUS AND CYCLIC REGENERATIVE PROCESS FOR MAKING OIL GAS. U. S. 2,807,528 (1957) September 27.

A one-or two-generator, double regenerator process is claimed for cyclic, pressure, regenerative manufacture of high Btu oil gas, with removal of cracked products directly from generator into a cooling zone, to avoid fouling the regenerators, and with flow of hydrogen or steam countercurrent and/or concurrent to the make oil into the generators.

H_2S Removal

Thompson, R. J. S. PURIFICATION OF COAL GAS USING STATIC BEDS OF IRON OXIDE. *Gas J.* (British) *291,* 329-31 (1957) August 14.

A discussion of what happens in a normal set of purifiers (particularly towers) in the process, and observations for further development.

This remains the most satisfactory and the cheapest method for the removal of H_2S.

Hydrogen Manufacture

Eickmeyer, A. G. WHICH WAY TO HYDROGEN? *Chem. Eng. Progress 53*, 361, 62 (1957) July.

This article presents a general discussion of the selection of a process for the manufacture of hydrogen. An example is given of pressure reforming for hydrogen production and the resultant savings. A checklist for project planning is provided, giving aspects to be considered when commercialization of a process is planned.

C. L. Tsaros

Industrial Gases

Forbath, T. P. NEW TECHNOLOGY CLAMORS FOR INDUSTRIAL GASES. *Chem. Eng. 64*, 206, 08, 10 (1957) August.

Industrial forecast indicates increasing use for O_2, N_2, argon, helium and H_2. All of these gases are finding new markets and production will be increased.

W. G. Bair

Reformed Gas

Hasche, R. L. (assigned to Koppers Company, Inc.) SEMI-MAKE AND HEAT REGENERATIVE PROCESS AND APPARATUS. U. S. 2,755,321 (1957) July 17.

This invention provides a highly efficient and economical process for the production of endothermic gas reaction products including acetylene, hydrazine, and aromatic compounds such as benzene. It comprises a cyclic process embracing a production or make step, and a heating step, these steps being alternated at appropriate intervals.

Weyh, W. SPITZENGASDECKUNG DURCH FLUESSIGGASKRACKEN IM DOG-GENERATOR IM GASWERK LEER (OSTFR.) (PEAK GAS SUPPLY BY CRACKING LIQUID GAS IN THE DOG-GENERATOR IN THE LEER GAS WORKS, OSTFR., GERMANY). *Gas-u. Wasserfach* (German) *98*, 825-33 (1957) August 16.

A procedure is described for obtaining peak gas supply by cracking a propane-butane mixture which gives excellent operating results and interchangeable utility gas. This procedure is particularly useful to small and medium sized gas plants. Investigations and calculations in Leer show that operation with the DOG-generator is also economical.

Shale Processing

Dyakova, M. K., Vol-Epshtein, A. B., Sovetova, L. S. and Aleksi, E. A. PROCESSING OF SHALE TAR RECOVERED FROM GAS GENERATORS USING BALTIC SHALE, TO MOTOR FUEL. CHEMICAL PRODUCTS, AND GAS. *Khim i Tekh. Topliva i Masel* (*Chem. Tech of Fuels & Oils*) (Russian), 28-38 (1957) No. 4.

Based on tests carried out in an experimental oven the authors proposed two methods for production of motor fuel, chemical products, and gas. Distillation of tar (steam or vacuum) followed by catalytic cracking of fraction above 320°C to semi-coke in a reactor with recirculating metal spheres as the heat carrier. Fraction below 320°C is subjected to methanol extraction, hydrogenation, and distillation. Based on tar, recovery includes: coke 29%, gasoline 12%, diesel fuel 27%, phenols 14%, neutral oxygenated compounds 11%, and gas 16%. Shale added to tar as catalyst 43%, hydrogen required 0.6%. The second method is similar to the first but omits catalytic cracking. Based on tar, recovery includes: fuel oil 73%, phenols 3%, neutral oxygenated compounds 5%, kerosine 7%, automotive gasoline 3%, gas and loss 3%. Hydrogen required 0.3%. J. W. Penney

Lozovoi, A. V., Krichko, A. A. and Mikheeva, R. A. LOW PRESSURE HYDROGENATION OF ENRICHED BALTIC SHALE. *Khim. i Tekh. Topliva i Masel* (*Chem. Tech. of Fuels & Oils*) (Russian), 32-40 (1957) No. 5.

Based on laboratory tests the process of catalytic hydrogenation of shale enriched to 85% organic matter and premixed with an equal weight of shale oil, is satisfactory for the production of liquid motor fuels and chemical products. Operating conditions are: total pressure of 100 atm.; temperature 400°-410° C; and reaction time 15 minutes. Organic content of shale increased to 85% by flotation and centrifuging in heavy liquids. Shale oil (225°-325°C) was obtained from distillation of shale tar. Of the many catalysts tested best results were obtained with nickel ores containing aluminum silicates.

J. W. Penney

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Canadian Gas

Hetherington, C. R. WESTCOAST'S BIG-INCH GAS LINE—FIRST FOR CANADA. *Oil Gas J. 55*, 122-26 (1957) August 19.

The Peace River exploration, development, legal problems, export market, construction of Westcoast pipeline, plant facilities and financing are briefly described for Canada's first "big-inch."

Hetherington, C. R. 5 TRILLION CUBIC FEET OF GAS READY FOR WESTCOAST. *Oil Gas J. 55*, 127-32 (1957) August 19.

Development of the Pacific Petroleum Ltd. Peace River five trillion CF gas reserve, its geology, well practice and by products are described.

Rowland, L. E. CANADIAN DRILLING ACTIVE DESPITE DROP IN OFFSHORE CRUDE SALES. *World Petrol. 28*, 90, 91 (1957) September.

Canadian crude output was up 24% in the first half of 1957, aided by sales to California refiners stemming from the Suez crisis. Prospects of gas sales stimulate drilling in certain areas. Gas-line construction is active. Reactions to the proposed Alberta-San Francisco line are discussed.

CANADA—OIL AND GAS UNLIMITED! FIELD AND RESERVOIR DATA. *Oil Gas J. 55*, 200, 03, 05, 06, 11, 12, 15, 16, 19, 22 (1957) August 19.

A complete list by province of Canadian oil and gas field and reservoir data for all wells is given.

Carbon Black Production

Bond, G. R. Jr. (assigned to Houdry Process Corp.) PREPARATION OF CARBON BLACK. U. S. 2,800,395 (1957) July 23.

A method is claimed for preparing a carbon black substitute comprising decomposition of normally gaseous hydrocarbons to products including free carbon by contact with a catalytic dehydrogenation component of the iron group characterized by forming volatilizable compounds, recovering the carbon-containing contact material and converting it to a volatilizable compound, and recovering the residue consisting substantially only of free carbon.

Campbell, E. D. and Friauf, G. F. (assigned to Godfrey L. Cabot, Inc.) PROCESS AND FURNACE FOR THE PRODUCTION OF CARBON BLACK. U. S. 2,801,157 (1957) July 30. An improved injector burner is claimed, in which an air-gas blanket surrounds the atomized oil spray.

Compression

Cramer, F. R. MORE ABOUT WATER INJECTION. *Gas 33*, 141, 43, 44, 46 (1957) August.

The benefits achieved by the injection of moisture into the scavenging stream of gas engines are discussed. Two tables of test data are included.

Kenworthy, C. S. SUPERCHARGING HORIZONTAL ENGINES IN THE FIELD. *Gas Age 170*, 42-44, 46, 47, 59, 60 (1957) July 11.

Low investment and reduced operating cost for a one-to three-year period show that supercharging horizontal engines in the field is a good investment. Fuel consumption was reduced from 10 to 8.8 CF per indicated compressor hp hour.

Morrison, W. L. (assigned to Constock Liquid Methane Corp.) METHOD AND APPARATUS FOR REDUCING POWER NEEDED FOR COMPRESSION. U.S. 2,799,997 (1957) July 23.

In vaporizing liquified natural gas for use as a fuel or process material, the power required for compressing a second gas is effectively reduced by cooling the second gas in an exchanger with the natural gas, then compressing, and cooling the second gas in exchange with water, in two or more stages.

Condensate Removal

Harrell, A. G. FIRST REPORT FROM GABE ON DESICCANT PERFORMANCE. *Petrol. Refiner 36*, 138-40 (1957) August.

To operate the refrigerated extraction plant at Gabe, Ky., Tennessee Gas Transmission Co. removes all moisture from the incoming gas

stream before cooling the feed to –105°F. To do this, TGT uses 16 dehydrators containing a total of 260 tons of desiccants. TGT reports on various desiccants and how they solved the fouling problem.

Laurence, L. L. (assigned to Black, Sivalls & Bryson, Inc.) METHOD OF AND APPARATUS FOR RECOVERING DESIRABLE HYDROCARBON LIQUIDS FROM HIGH PRESSURE WELLS. U. S. 2,801,207 (1957) July 30.

Gas from producing wells is freed of water, cooled at controlled temperatures and pressures to separate the oils and condensates, and expanding these to cool and condense the separated gas, then combining and stabilizing the condensates.

Miller, E. G. (assigned to Jefferson Lake Sulphur Co.) CYCLIC ADSORPTION PROCESS FOR THE RECOVERY OF ETHANE FROM A GASEOUS MIXTURE CONSISTING OF METHANE AND ETHANE. U.S. 2,799,360; CYCLIC ADSORPTION FOR REMOVAL AND/OR RECOVERY OF H_2S FROM NATURAL GAS. U.S. 2,799,361; CYCLIC ADSORPTION PROCESS. U.S. 2,799,362, 2,799,-363, 2,799,364 (1957) July 16.

Narrow cylindrical adsorbant-filled vessels mounted between upper and lower distributing manifolds rotatable on a shaft within an enclosing pressure vessel are used to remove continuously a particular gaseous component from a gas mixture by arranging the sliding-disc manifold connection and auxiliary equipment so that each adsorbing vessel in turn becomes a 1st purging zone, 2nd purging zone, 3rd purging zone, 3rd adsorption zone, 2nd adsorption zone and 1st adsorption zone. The process is applied in five patents for the removal of ethane, H_2S and moisture from natural gas.

Conversion Procedure

Woods, W. P. CONVERSION: PROBLEMS AND SOLUTIONS. *Gas Age 120*, 22, 56, 57 (1957) August 8.

The three types of problems which come from conversion from manufactured to natural gas are: 1) those that could have been eliminated through more careful prior planning, such as public relations and instructions; 2) those that are usually encountered on every conversion job as in appliance repairs; and 3) phases that should be given careful study during the planning period, such as employee and public cooperation.

Jones, H. C. EXPERIENCE: GUIDE TO CONVERSION. *Gas Age 120*, 17-21 (1957) August 8.

An account of the policy and procedure in 15 New England companies which offers a guide to gas utilities who are facing the change to natural gas.

Customer Service

Turpish, J. V. and Pruitt, R. D. FACTORS TO CONSIDER IN SELECTING CUSTOMER SERVICE VEHICLES. *Gas 33*, 67 68, 71, 72 (1957) August; Amer. Gas Assoc. Oprtg. Sect. Paper DMC-57-12.

A comparison of the relative utility of the business coupe and the pickup truck for customer service work is presented. G. G. Wilson

Distribution Control

Precheur, H. V. COMPUTING TELEMETERING SYSTEMS IN GAS DISTRIBUTION NETWORK. *Gas 33*, 45-50 (1957) September.

The first Bristol flow computing system installed by Public Service Electric & Gas Co. is described. This system measures gas flows and pressures at Hanover, N. J. and transmits data to the main dispatching center at Harrison, N. J. which records and regulates the flow by telephone line sound-frequency signals. Eventually this central flow-control will be applied to 12 fringe stations handling natural gas.

Singer, A. C. "PLANT CUT" METHOD SIMPLIFIES PROBLEM OF EXTENDING DEAD END LINES. *Amer. Gas. J. 184*, 21, 22 (1957) September.

To control flow of gas in the line for construction and maintenance purposes a saw-cut is made down through the upper half of the main with a slot 0.051 in. wide. A piece of stainless steel inserted into the slot is shaped so to fit the internal contour of the live main, stopping the flow of gas. With flow control, a cut can now be made into the line and a valve or tee installed.

Zeigler, B. E. TELEMETERING REPAYS COST IN ONE MONTH. *Gas Age 120*, 43, 45-49 (1957) September 5.

Peak load control made possible by telemetering returned the cost of installation to Public Service Co. of North Carolina in one month in additional revenues. Line packing to give extra quantities of gas for industrial customers is one of the principal advantages of controlled rate of flow stations and telemetering system.

"DRY RUN" TESTS SHUT DOWN SYSTEMS. *Pipe Line Ind. 6*, 48, 49 (1957) July.

Will your emergency system shut down swiftly and safely when necessary without a mishap? Because Panhandle Eastern Pipe Line Company wanted to make sure, every piece of emergency control equipment is being used periodically under actual operating conditions.

District Supply

Chandler, M. HOW NIG IS MEETING THE HEATING BOOM. *Gas Age 120*, 44, 46 (1957) August.

Additional pipeline supply, more gas from Herscher, and cavern storage of propane allows heating service to 30,000 more homes; but 110,000 remain on waiting list for Northern Illinois Gas Co.

Lutz, J. P. Jr. HOW TO ENCIRCLE A CITY WITH A HIGH PRESSURE LOOP. *Gas 33*, 56, 58 (1957) September.

The original 1926 layout and recent extensions of the Worcester, (Mass.) Gas Light Co. high-pressure loop line are described.

Toynbee, P. A. CALCULATION OF PRESSURE LOSSES IN HIGH-PRESSURE TRANSMISSION OF GAS. *Coke and Gas* (British) *19*, 339-41 (1957) August.

The Fanning equation, modified for use with compressible fluids, has a general application. This equation is developed and discussed and the results of calculations based upon it are presented in graphical form.

COMMUTING DITCHERS SPEED NEW MAINS. *Gas Age 120*, 11-13 (1957) August 22.

A description of the operation of two small machines which travel more than 70 miles every weekend to expedite laying of new distribution network at Newville, Wis. as the Mich-Wis line brings gas into the resort community.

VORAUSBERECHNUNG DES KUNFTIG MOGLICHEN GASABSATZES IM VERSORGUNGSGEBIET FRANKFURT AM MAIN UND DER TECHNISCHE UND WIRTSCHAFTLICHE AUSBAU (ESTIMATION OF THE FUTURE POSSIBLE GAS SUPPLY IN THE AREA OF FRANKFURT ON MAIN AND THE TECHNICAL AND ECONOMICAL DEVELOPMENT). *Gas u. Wasserfach* (German) *98*, 785-88 (1957) August.

Information is given about the planning and development of new gas supply and distribution iinstallations, and the estimation of possible future gas supply. Though the study was made in 1952, the calculations comply with current requirements.

Drilling

Brown, N. F. FREE PISTON PROVES ECONOMICAL IN REMOVING WATER TO INCREASE GAS WELL PRODUCTIVITY. *Petrol. Eng. 29*, B90, 97, 98, 100, 01, 04, 07 (1957) September.

By providing a solid interface between the base of a column of liquid being lifted out of a well and the gas that does the lifting, a free piston gas-lift device has increased gas production from 18 San Juan Basin wells by 36.2%. The next step in exploiting the potential benefit of the free piston will be the adoption of 1-1/2 and 1-1/4 in. tubing strings. This move is already being anticipated by the operators in New Mexico.

Edmondson, C. EQUIPMENT: POSTPONED BUYING BUILDS BACKLOG OF DEMAND FOR TOOLS. *Drilling 18*, 109, 10 (1957) September.

Postponed purchasing has brought new problems to the contract drilling and supply industries during recent months. Increased drilling activity is expected. *Drilling's* survey shows the contractors are preparing for this increase but not the suppliers. Because of this, serious shortages of capital equipment and tabular goods may arise.

Gresham, W. C., Mecham, O. E., Ward, K. J. and Ashby, R. H. DRILLERS TAKE A LOOK AT AUTOMATION. *Oil Gas J. 55,* 101-03 (1957) August 12.

A new automatic weight-control device is portable, easy to install, accurate, and low in cost and maintenance. In the Rocky Mountain area this device has performed successfully in straight drilling, coring, and whipstocking operations.

Guyod, H. and Kanner, L. C. HOW TO FIND TRUE RESISTIVITY FROM THREE NORMAL CURVES. *Oil Gas J. 55,* 107, 10, 11 (1957) September 9.

This is a supplementary procedure for using Chart 8 in the log-analysis series by R. C. Hamilton and P. Charrin (*Oil Gas J. 55,* 121 (1957) March). It shows how to treat nonuniform formations, unreliable mud resistivity values, and various hole diameters.

Huddleston, B. P. and Strange, W. D. THE FUTURE OF AERATED FLUIDS IN THE DRILLING INDUSTRY. *J. Petrol. Tech 9,* 11-14 (1957) August.

The present techniques of air or gas drilling and their advantages and disadvantages are discussed. The relative merits of both air and mud drilling provide the basis for the advent of aerated fluids. Aerated fluids are discussed as two phases, physical composition and circulation techniques.

McLaughlin, P. L. CHEAPER DRY HOLES POSSIBLE THROUGH NEW AIR AND GAS DRILLING CONCEPTS. *World Petrol. 28,* 46-49 (1957) August.

A review of the technological advances of air drilling, with a listing of advantages and limitations. Careful consideration of individual factors of local geologic conditions will lead to its intelligent use.

Simon, R. FASTER PENETRATION RATE SOUGHT BY VIBRATING BIT. *Drilling 18,* 136, 231 (1957) September.

Battelle Memorial Institute has developed a vibratory drilling machine for Drilling Research, Incorporated. The transducer technique is essentially a column of material (in this case nickel) whose length changes slightly when magnetized. Rates of penetration of two to three times those with rotary drilling were achieved with laboratory and field models.

Gas Liquefication

Lederman, P. B. and Williams, B. WILL LIQUEFACTION OF NATURAL GAS PAY? *Petrol. Refiner 36,* 169-75 (1957) August.

This study covers the cost to liquefy natural gas at cheap sources and ship it to New York and the North Sea. It is necessary to examine various liquefaction capacities and typical cycles; that is, refrigeration schemes, in addition to the various factors which influence shipping and storage costs. It appears that the most economical cycle available is the propane-ethylene-methane (natural gas) cascade cycle.

Skaperdas, G. T. (assigned to The M. W. Kellogg Co.) REMOVING IMPURITIES FROM A GAS LIQUEFACTION SYSTEM WITH AID OF EXTRANEOUS GAS STREAM. U.S. 2,802,349 (1957) August 13.

The method is claimed of separating the constituents of a compressed gaseous mixture by liquefaction and fractionation, which comprises cooling a major part of the compressed mixture to above its liquefaction temperature in a reversing heat exchange with at least one cold product fraction of separation passing countercurrently to precipitate an impurity, periodically interchanging the paths of flow whereby the product fraction passes over the precipitate and causes the evaporation and removal thereof.

Gas Purification

"American Correspondent" SOME OPERATING PROBLEMS IN ETHANOLAMINE GAS PURIFICATION. *Gas World* (British) *146,* 380-83 (1957) August 31.

Commercial gas treating with ethanolamine solution began some 27 years ago. Amine treating has become nearly universal practice for the removal of acid components (hydrogen sulfide and carbon dioxide) from refinery and natural gases. Today, a multiplicity of amine treating processes and specific plant conditions poses operating problems. This article emphasizes the areas in which such problems occur,

and steps that have been proved successful in actual plant operation.

Hydrocarbon Recovery

Cannon, R. "MARGINAL OPERATION" PAYS OFF IN TREND-SETTING LEAN-GAS PLANT. *Petrol. Processing 12,* 62-65 (1957) August.

A discussion of the following factors which make the Sunray Mid-continent gas plant operate on inlet gas with less than one gal/MCF: adsorption at low temperature (−10°F); low fuel requirements (less than 1.3 volume-percent of gas charged; and low operating costs (two operators per shift).

Givens, H. C. NEW ABSORPTION SYSTEM LEADS TO HIGH ETHANE RECOVERY, BETTER EFFICIENCY. *Oil Gas J. 55,* 104, 05 (1957) August 12.

The Falfurrias, Texas natural-gasoline plant of La Gloria Oil & Gas Co. uses unusual applications from conventional absorption and related equiment to provide a product gas of about 53% ethane and 47% methane. Its success is due to two steps in the operation. In the first, vapors from the high-pressure flash drum are recompressed to absorber pressure and enter high-pressure absorber four trays below the main gas stream. Here ethane and propane in the recompressed vapors exchange places with methane in the oil. In the second, vapors from each lower-pressure flash drum are recompressed and joined with the respective rich oil for additional enrichment of the absorbed gas.

Leakage

McElwee, L. A. and Scott, T. W. THE SONIC LEAK DETECTOR. *Amer. Gas J. 184,* 14-17 (1957) August.

The sonic method for detecting leaks in pipelines has proved to be useful for finding the exact location of leaks in gas mains. With equipment that has already been field tested, 1000 ft. of gas main can be surveyed for leakage by making only two taps. Leaks can be located accurately, making necessary an excavation of only the size needed.

LP—Gas Market

Abell, C. CROP DRYING. THE NEXT GREAT FARM MARKET FOR LPG. *Butane-Propane News 19,* 43-50 (1957) September.

Mechanical crop drying with forced hot air will develop into the next great farm market for LPG. Because of the nature and the location of the operation, LPG offers the convenience and economy that give it a decided advantage over liquid and solid fuels. An important part of such consumption of fuel is in the summer or early fall, making this a desirable load balancing market.

COUNCIL SURVEY FINDS FARMS TO BE BETTER CUSTOMERS TOMORROW *LP-Gas 17,* 46-50 (1957) September.

National LP-Gas Council polled 2,250 dealers to determine where LP-gas and appliances now are being sold and are expected to be sold in the future. The council survey showed the nation's farmer remains the industry's biggest customer, accounting for 45% of total dollar retail sales against 30% for small towns and 17% for suburban. The survey also forecasts a five percent pickup in LP-gas farm consumption and a six percent rise in farm customers.

LP—Gas Metering

Batchelder, G. E. HOW TO METER HIGHLY VOLATILE LIQUIDS. *Petrol. Processing 12,* 70-73 (1957) August.

Four causes of vaporization in volatile-liquid systems are described and illustrated. Six rules for a correct metering installation are listed, and two systems for the transfer of LPG and other low boiling-point liquids are explained.

Maintenance

Sisca, F. J. "PERMANENT PATCHING" IS FASTER AND BETTER. *Amer. Gas J. 184,* 25-28 (1957) September.

The most vulnerable of all maintenance work is the replacement of pavement. Rochester Gas & Electric Co. developed a new method to reduce cost and improve public relations. Contractor started permanent repairs on pavement the same day that the gas work and backfilling were completed. The edges of the old pavement were heated to assure bonding. Final asphaltic mixed sheet coat was made on the job. Coordinated repair work replacement was made using two-way radio contact.

Ungethuem, E. HERE'S HOW TO STRETCH THE MAIN MAINTENANCE DOLLAR. *Gas Age 120*, 13-16, 59 (1957) September 5.

A four-step procedure in use at Milwaukee Gas Light Co. is renovating cast iron main with a minimum of interference and inconvenience to traffic and customer; 1) isolation of a section of main to be treated; 2) cleaning of main and services; 3) internal treating and testing of mains and services by the "Gutenite" process.

Mexican Gas

MEXICAN GAS CROSSES BORDER. *Gas Age 120*, 32-34 (1957) September 19.

Mexican sources will supply 126 MMCF initially, and will help Tetco to meet Northeast and Midwest demand. Gas is coming from the Brazil, Trevino, and Lomitas fields in northeastern Mexico. Processed at the Pemex plant at Reynosa, the gas is delivered into Texas Eastern's system at the border.

Odorization

Billett, L. R. OPERATING EXPERIENCES WITH PUMP-TYPE ODORIZERS. Amer. Gas Assoc. Oprtg. Sect. Paper CEP-57-6 (1957) May 20. *Gas 33*, 74-81 (1957) September.

The experience of Northern Illinois Gas Co. with pump-type odorizers is discussed in great detail.

Nechaev, M. A., Troitskoya, M. N. and Drabkin, A. E. INVESTIGATION OF EFFECTIVENESS OF ODORIZATION OF SHALE GAS. *Gazovaya Promysh.* (*Gas Ind.*) (Russian), 29-31 (1957) No. 6.

Shale gas without added odorant does not have sufficient odor to warn of explosive or toxic danger. Increasing the content of shale gasoline in the gas from its normal value of 9.5 g/m^3 to 40 g/m^3 was not satisfactory. However, odorization with ethyl mercaptan proved to be satisfactory. Odor testing equipment and procedure is described in detail. J. W. Penney

Offshore Operations

Dekinder, E. L. PROBLEMS IN MEASURING OFF-SHORE GAS. *Amer. Gas Monthly 39*, 36-28 (1957) September.

Measurement problems begin on the offshore platform because a single trunk line to the shore transports both the gas and liquid collected by several companies. Gas and liquid streams must be measured separately. One platform may have several wells, and trunk lines must carry the stream from it plus streams from several other platforms of different ownership.

Taylor, D. M. THE GRAPHIC STORY OF OFFSHORE OIL. *Petrol. Eng. 29*, B105, 06-08, 16 (1957) August.

About 50 companies have invested over a billion dollars into the offshore oil trend. Since 1953, almost 1/3 of the wildcats in the water have been discoveries. Ownership—state or Federal—is still undecided, but with the high discovery rates and low geophysical costs, the outlook is bright.

PLATFORM PROPOSED FOR 600-FT. WATERS. *Petrol. Week 5*, 21, 22 (1957) September 20.

An offshore platform able to operate in waters 600 ft. deep has been designed by LeTourneau, Inc. Up to now, drilling has been restricted to waters 125 ft. deep. The continental shelves of the U.S. cover about 750,000 sq mi of which about 130,000 sq mi are in the Gulf of Mexico.

Pakistan Gas

FIRST EAST PAKISTAN GAS WELL BROUGHT IN. DEVELOPMENTS AT SYLHET. *Gas World* (British) *146*, 396 (1957) August 31.

The first gas well of East Pakistan was brought in as a producer on July 20 at Sylhet. The open flow potential as calculated according to the Railroad Commission of Texas formula is more than 100 MCF per day and is therefore comparable with the Sui wells.

PAKISTAN NATURAL GAS CONSUMPTION MULTIPLIES 40 TIMES IN 22 MONTHS. *Gas World* (British) *96*, 265 (1957) August 10.

The reserves of natural gas in Pakistan are enough to meet fuel requirements for more than a century. The industries which have turned to natural gas are listed. Price comparisons are given between gas and oil.

Peak Load

Mergner, W. 3,000,000 CF PER HOUR! *Amer. Gas J. 184*, 14-20 (1957) September.

This largest LPG-air gas plant, in both capacity

and area, provides peak-shaving gas for northern New Jersey customers of Public Service Gas & Electric Company of New Jersey.

Denny, L. C. LOAD-BALANCING BIBLIOGRAPHY. *Butane-Propane News 19*, 64, 66, 68 (1957) September.

A list of 140 articles all on load-balancing subjects which have been published over the past 13 years.

Oberseider, J. L. ECONOMIC AND ENGINEERING EVALUATIONS OF ALTERNATE METHODS FOR MEETING PEAK DEMANDS. *Amer. Gas. J. 184*, 21-32 (1957) August.

Data from studies made by the Southern Calif. Gas Co., Southern Counties Gas Co. of Calif. and others are usable for making cost estimates for preliminary economic and engineering evaluations for meeting peak demands. The report gives graphic presentation of capital, manual and unit costs of additional primary gas supply, above ground holders, and underground storage. Generally focusing on costs, it also briefly describes technological functions.

Pipeline Construction

Brown, R. J. SOIL MECHANICS IMPORTANT IN MARINE PIPELINE CONSTRUCTION. *Oil Gas J. 55*, 151, 53-55 (1957) September 16.

Unstable soil along the Gulf Coast poses a threat to pipelines. Some companies have experienced excessive vertical displacement involving newly completed lines. Two possible preventive measures: 1) during construction fill pipe with water, bury and allow time for rehealing of soil before removing water; and 2) use heavier pipe and backfill.

Strong, R. G. and Barkow, A. G. LOOPHOLES IN THE PIPELINE CODES. *Oil Gas J. 55*, 162, 63, 65, 69, 71, 74, 76 (1957) September 16.

A plea is made for a more realistic approach to designing a set of specifications that both the user and manufacturer can live with.

Pipeline Communications

Chapman, F. MORE THAN 200 WITNESSES TESTIFY IN MICROWAVE CASE. *Gas 33*, 149, 50, 52, 54 (1957) August.

A summary of the testimony in hearings conducted by the FCC to provide background information for the development of new microwave rules and regulations governing their allocation and use on pipelines. G. G. Wilson

Chapman, F. FCC HEARINGS REVEAL INDUSTRY'S PLANS FOR MICROWAVE. *Gas 33*, 133, 34 (1957) September.

Testimony at the FCC hearings on allocation of microwave frequencies permits an estimate of its present usage in gas industry communications, and the contemplated expansion in operations, data processing and remote controls.

Long, F .V. PRESENT AND FUTURE MICROWAVE—PIPELINE STYLE. *Gas 33*, 120-22 (1957) September.

Development, quality and applications of microwave communication systems for pipeline use are discussed from a standpoint of cost, maintenance and design.

Reservoir Engineering

Aycock, W. P., Hough, E. W. and Crawford, G. W. A NEW TECHNIQUE FOR EXAMINATION OF OILFIELD BRINES. A.I.M.E. Tech. Note 435. *J. Petrol Tech. 9*, 53-56 (1957) August.

Forty oilfield brines examined by a polarographic technique called the "tensammetric method" represent brines produced from 16 different formations of various geologic ages. Most of the samples were from active water drive. Response curves of an oilfield brine representative of a particular geologic environment may be of value in reservoir engineering in the interpretation of surface and interfacial phenomena.

Bradley, H. B. and Mullins, L. D. POTENTIOMETRIC ANALYZER PREDICTION OF PRESSURE DISTRIBUTION IN A GAS-CONDENSATE RESERVOIR. *J. Petrol. Tech. 9*, 59-60 (1957) September.

This note extends the application of the potentiometric analyzer to the prediction of pressure distribution in gas-condensate reservoirs.

Brooks, C. S. AN EVALUATION OF THE PROCEDURES USED IN THE DETERMI-

NATION OF THE GRAIN DENSITIES OF PETROLEUM RESERVOIR MINERALS. A.I.M.E. Tech Paper 4615. *J. Petrol. Tech. 9,* 235-44 (1957) August.

Methods for determination of effective grain densities of minerals have been evaluated for accuracy and precision, and application to petroleum reservoir minerals tested. Consideration was given to the effect of consolidation, swelling clay, and wettability on these grain-density determinations. Results provide a basis for selection of most suitable method for various petroleum reservoir minerals and for estimation of formation porosity.

Campbell, J. M. HOW TO CALCULATE FLOWING B.H.P. OF GAS WELLS. *Oil Gas J. 55,* 114, 17 (1957) September 9.

Calculation of flowing bottom-hole pressure is similar to that of static pressure, except that one must compensate for the friction loss, in addition to the head of gas acting on the bottom of the well.

Clark, N. J. Andreen, G. M. and Wessely, A. J. LATEST OIL RECOVERY IDEA. *Petrol Eng. 29,* B21-26 (1957) September.

A water bank in front of an LPG slug followed by gas injection combines the favorable features of miscible displacement with waterflooding to improve conformance and displacement efficiency, and to achieve maximum ultimate oil recovery.

Lesem, L. B., McKetta, J. J. Jr. and Fancher, G. H. A STUDY OF THE ORIFICE WELL TESTER AND CRITICAL FLOW PROVER. *J. Petrol. Tech. 9,* 61-64 (1957) September.
ASME-A.G.A. specifications should be used for the construction of orifice well-tester. These plates should be made of stainless steel or Monel metal. Official manuals of procedure should require the use of such plates and appropriate tables in all gas-oil ratio work.

Merliss, F. E., Doane, J. D. and Rzasa, M. J. HOW ROCK AND FLUID PROPERTIES AFFECT FLOW IN THE RESERVOIR. *Oil Gas J. 55,* 153-59 (1957) September 2.

A study of two-phase fluid flow is necessary to understand flow processes and their application to reservoirs. This article presents results of a study of external gas and water drives, solution-gas drives, and steady-state flow.

Wansbrough, R. S. HOW TO EVALUATE GAS WELL DAMAGE BY PRESSURE BUILD-UP TESTS. *Petrol. Eng. 29,* B47-50, 52 (1957) September.

Routine well problems may now be analyzed and solved as a result of tests, using recent studies of unsteady flow of compressible fluids in porous media.

Storage Wells

Walker, C. J., Corliss, E. R., Miller, J. S. and Dunning, H. N. HOW GAS STORAGE WELLS BEHAVE. Part 1. *Petrol. Eng. 29,* D35, 38-40 (1957) August; Part 2. *Ibid.* D29-31 September.

The Bureau of Mines' studies in two fields yield conclusions regarding type of tests that will give best deliverability data. Six gas-storage reservoirs have been tested during cycles of injection and withdrawal to understand the principles of gas flow and gas-well behavior. Preliminary results on the Ulan reservoir in southern Oklahoma are presented. A new measure of deliverability called the "Q_{10}" value, is suggested as a replacement for the "open flow" and "C" values that have been used previously.

Underground Storage

Delsol, R. and Richard, M. L. LE STOCKAGE SOUTERRAIN DU GAZ DE COKERIE A BEYNES. (UNDERGROUND STORAGE OF COKE OVEN GAS AT BEYNES). Preprint A.520, Assoc. Tech. Gas, Bordeaux (1957) June 10-15; *J. Usines Gas* (French) *81,* 295 (1957) July; *Gas World* (British) *146,* 32-34 (1957) July 6.

An underground storage reservoir near Versailles at Beynes is almost completed. It will hold 10,000 MCF, though only one half of this amount will be reclaimable. By April of this year, 1,000 MCF has already been sent underground and much more is expected.

Hudson, T. B. (assigned to Phillips Petroleum Corp.) UNDERGROUND STORAGE SYSTEM. U. S. 2,803,114 (1957) August 20.
Designed for storage of LPG the system consists of a battery of vertical drilled holes, possibly 36 in. in diameter, 100 feet deep, with metal liners anchored in place with cement, and

capped. A water pipe extends to the bottom of each lined hole; admission of water displaces the LP-gas for delivery from storage.

Utility Costs

Vogel, O. S. VARIATIONS OF CAPACITY COSTS IN UTILITY SERVICE. *Public Util. Fortnightly 60,* 226-39 (1957) August.

There are many differences in cost and price of natural gas as compared with electric utility operations. Here is an analysis on how capacity costs vary in relation to the different types of utility service.

Valuation Methods

Awalt, C. A. SHORT CUT VALUATION OF PRODUCING PROPERTIES. *Petrol. Eng. 29,* B39, 40 (1957) August.

This is a simplified approach for the estimation of oil and gas producing property values. Market value is determined by the total future net revenue, the time within which it can be realized, and the discount applicable due to the time element. Accuracy of results depend on the variation from a constant percentage in the decline in producing rate.

Well-Practice

Prian, R. C. and Gomez, O. R. PREDICTING GAS-CONDENSATE WELL PRODUCTIVITY. *Petrol. Eng 29,* B53, 56, 58, 60, 62, 64, 66, 68, 76 (1957) August.

Gas flow rate, within ten percent error, can be predicted by knowing: static bottom-hole pressure or depth of productive interval; permeability; productive interval and size of tubing.

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Australian Oil

Taylor, J. C. M. THE OIL GEOLOGY OF THE AUSTRALASIAN REGIONS. *Petrol.* (British) *20,* 327-30 (1957) September.

The Australasian regions contribute an appreciable proportion of the world's oil—present production is about 1/10 that of the Middle East, and almost all comes from fields in the islands of Sumatra, Java, Borneo and Dutch New Guinea. The geology, present exploration and prospects of these islands are described.

Canadian Refining

Weber, G. CANADIAN REFINING HAS GROWING PAINS. *Oil Gas J. 55,* 135-38, 41 (1957) August.

With 1956 flow of 630,000 bbl. crude per day to Canadian refineries, the refining industry continues to expand with four new refineries (90,000 bbl.) planned for 1961 and five companies projecting greater additions.

Equipment Exports

U.S. AND EUROPE SHARE BIG LOAD IN TOOLING THE OVERSEAS OIL BOOM. *Petrol. Week 5,* 40-42, 45-52 (1957) August 23.

The hunt for foreign crude oil in international companies must meet a foreign oil demand growth that is doubling the U. S. rate. Results of an interview of 55 oil and equipment men concerning the job of equipping the expansion abroad are presented.

Exploration

Gallup, W. B. WILL THESE SEDIMENTARY BASINS PROVE OIL BEARING? *Oil Gas J. 55,* 142, 46, 49, 50, 53 (1957) August.

It is probable that in the Gulf of Alaska, Hecate Strait, and Georgia Strait, (all along the Pacific shore) oil will eventually be found, but only following a serious combined geological and geophysical program.

Gutstadt, A. M. GEOLOGICAL STUDY SHOWS CAMBRIAN AND ORDOVICIAN OIL POSSIBILITIES FOR INDIANA. *Oil Gas J. 55,* 216-18 (1957) September 2.

Six oil and gas possibilities are listed and explained, among them: Mt. Simon sandstone and Eau Claire formation; Knox (?) dolomite; St. Peter sandstone; Black River limestone; Trenton limestone, and Cincinnatian series and Maquoketa shale.

McCaslin, J. C. WILDCAT FEVER BREAKS OUT OVER WIDE WILLISTON AREA. *Oil Gas J. 55,* 219, 20 (1957) September 2.

Important oil discoveries in Montana, North Dakota, and South Dakota are reviving lagging exploration in this scarcely tapped basin. The outlook for similar wells and the drilling there is described.

Moore, C. A. PINPOINTING PANHANDLE POSSIBILITIES. *World Oil 145,* 83-88 (1957) September.

A number of subsurface provinces are now

being actively explored for oil. These provinces include the broad uplifts on which many major fields have been found, and the sedimentary basins and embayments in which present exploration is being conducted, with sporadic success. An attempt is made here to evaluate this current exploration activity.

Morrisey, N. S. DRY-HOLE GRAVEYARD TO MAJOR PROVINCE. *Oil Gas J. 55,* 84-90 (1957) September 9.

The spectacular Four Corners area in Utah is described with relation to structure, geology and development operations.

Fuel Oil

Gray, R. FUELOIL 1957 . . . PROBLEMS AND PROFITS. *Fueloil and Oilheat 16,* 53-62 (1957) September.

Although there have been set-backs, the industry had a profitable 1956-57 oil heating season. The volume of distillate fueloil sold was apparently lower than a year earlier. Sales of oil-heating equipment through this calendar year have been down about 14% January to June.

Gasoline Plant

Brosamer, R. J. and Eaheart, C. G. NEW GASOLINE PLANT PROCESSES GAS FROM 14 TEXAS POOLS. *Oil Gas J. 55,* 100-02 (1957) September 9.

Gathering and gas processing systems of the Phillips Petroleum Co. plant at Andrews, Texas are discussed.

Geological Research

NEEDED: MORE GEOLOGICAL RESEARCH. *Petrol. Week 5,* 19, 20, 23 (1957) September 6.

The Amer. Assoc. of Petrol. Geologists has just completed a study of research needs in petroleum geology. Relative ranking of research categories, in order of needs are: 1) geologic history of sedimentary basins; 2) migration, and accumulation or petroleum; 3) characteristics of dominantly carbonate sediments; 4) characteristics of dominantly detrital sediments; 5) miscellaneous (surveys, and the like); 6) minor sedimentary types; 7) correlation and age dating of sediments; and 8) tectonics.

Oil in Washington

Gardner, F. J. WASHINGTON—NEW OIL-PRODUCING STATE. *Oil Gas J. 55,* 215, 16 (1957) September 2.

Washington's first commercial oil strike is anticipated for the Ocean City area, Grays Harbor County. An oil well there flowed 223 bbl. daily on production tests recently.

Oil Shale

Matzick, A. and Cameron, R. J. RECENT DEVELOPMENTS IN OIL SHALE. *World Petrol. 28,* 68-71 (1957) September.

Activities of Union, Sinclair, Aspeco and the U. S. government in processing, mining and surveying oil shale are discussed.

Refining Operations

PETROCHEMICAL REPORT . . . TWO SPECIAL SECTIONS. *Oil Gas J. 55,* 107-141 (1957) September 2.

Fifteen processes are selected for refiner and petrochemical manufacturer. They include the manufacture of ethylene, acetylene, butadiene, oxidation products of butane and propane, aromatics, specialty polymers of propylene, ammonia, sulfur, and carbon black. A survey covering new plants, existing plants, and new products is divided into six tables: organic chemicals; ammonia and nitrogen products; butadiene and synthetic rubber; sulfur-conversion plants; carbon black; and Canadian petrochemical plants.

Secondary Recovery

Stormont, D. H. BOTTOM-HOLE HEATING SPEEDS FLOW OF HEAVY CALIFORNIA OIL. *Oil Gas J. 55,* 142-51 (1957) June 24.

Use of this technique in heavy crude oil wells has increased oil production and the cost of pumping is reduced. G. Matus

Synthetic Liquid Fuels

Ta-Yu, C., Nan-Tzuen, L. and Chun-Hao, C. RESEARCH ON SYNTHESIS OF LIQUID FUELS. *Petrol.* (British) *20,* 336-40 (1957) September.

Research on the synthesis of liquid fuels from CO and H_2 via a fluidized process has been in progress at the Chinese Institute of Petroleum for over three years. Pilot-plant data using a nitrided fused-iron catalyst have been obtained. The cobalt catalyst has also been investigated. Surface complex of silica and cobalt was found to be closely related to the quality of the catalyst.

7. ANALYTICAL METHODS AND TESTS

Continuous Air Testing

Rogers, L. H. HIGH SENSITIVITY CONTINUOUS INSTRUMENTATION FOR ATMOSPHERIC ANAYLSIS. *Chem. Eng. Progress 53,* 381-84 (1957) August.

Application of continuous recorders to air pollution work is a special field in which high sensitivity is frequently the most important design criterion. Methods for improving sensitivity are cited, with examples of instruments using these procedures to illustrate developmental trends. Most of these instruments could be used for process stream analysis.

Distillation Labs

Kincannon, C. B. and Baker, M. O. ANALYTICAL DISTILLATION LABORATORY DESIGN FOR EFFICIENCY AND VERSATILITY. *Anal. Chem. 29,* 1189-93 (1957) August.

Laboratory arrangements for efficient distillations are designed for any of a variety of types of columns and are provided with utilities for automatically maintained pressures. Constant boil-up rates are obtained by differential pressures. Panels allow for rapid selection of reflux ratios and for reading of vapor temperatures. Man-and column-hours per distillation were reduced 25% and 35% respectively. Improved safety equipment is described.

Gas Chromatography

Janak, J. NEUE WEGE DER GASANLYSE MIT GASCHROMATOGRAPHIE (NEW WAYS OF GAS ANALYSIS WITH GAS CHROMATOGRAPHY). *Erdoel u. Kohle* (German) *10,* 442-44 (1957) July.

Terminology is presented as well as the newest results of research obtained in the field of separation of permanent gases. The investigation of modified absorption media is presented. G. Matus

Morrow, H. N. and Buckley, K. B. NEED HELP WITH GAS CHROMATOGRAPHY? *Petrol. Refiner 36,* 157-61 (1957) August.

The columns and partition liquids are suggested for trial in this report. Due to its speed, simplicity, reliability and low operating cost, gas chromatography analysis is preferred whenever possible. Efforts were concentrated on finding adequate partition columns to do the jobs required, and many of the present columns will be replaced when there has been time to test some of the 20 or more potential partition liquids on hand. Information given is general and can be applied to most makes of instruments.

Rosie, D. M. and Grob, R. L. THERMAL CONDUCTIVITY BEHAVIOR. IMPORTANCE IN QUANTITATIVE GAS CHROMATOGRAPHY. *Anal. Chem. 29,* 1263, 64 (1957) September.

The thermal conductivity behavior of similar hydrocarbons may be quite different causing large errors in gas chromatography. Conductivities of a number of hydrocarbons have been compared to benzene and relative signal response per mole of hydrocarbon determined. Through use of this calibration factor quantitative results can be obtained for a mixture of hydrocarbons.

Ryce, S. A. and Bryce, W. A. ANALYSIS OF VOLATILE ORGANIC SULFUR COMPOUNDS BY GAS PARTITION CHROMATOGRAPHY. *Anal. Chem. 29,* 925-28 (1957) June.

A method is described for the analysis by gas partition chromatography of a sample containing H_2S, methyl, ethyl, and propyl mercaptans, dimethyl and diethyl sulfides, dimethyl disulfides, and thiophene. The sulfur compounds have also been separated from light hydrocarbons and from methanol and ethanol. Benzene and thiophene were also separated. A method is outlined for determining the sensitivities of the instrument to vapor samples containing air. The relationship among retention volume, polarity of the column liquid, and polarizability of the gases being analyzed is discussed.

Hydrogen in Metal

Fatzer, E. G. AN APPARATUS FOR DETERMINING HYDROGEN CONTENT OF TITANIUM AND ITS ALLOYS. *Ind. Lab. 8,* 22-33 (1957) September.

Titanium-hydrogen equilibria which influence the release of hydrogen, and accuracy of hydrogen determination are discussed. The development and operation of a "warm extraction" method, with vacuum pumpiing of titanium at 1840°F is given in detail.

Hydrocarbon Analysis

Kuehnhanss, G., Roesner, H., Huettig, E., Wagner, M. and Tischendorf, G. BEITRAG ZUR ANALYTIK VON KOHLENWASSERSTOFFGEMISCHEN. 2. ENTWICKLUNG EINER SCHNELLANALYSENMETHODE (CONTRIBUTION TO THE ANALYSIS OF HYDROCARBON MIXTURES. 2. DEVELOPMENT OF A RAPID ANALYSIS METHOD. *Erdoel u. Kohle* (German) *10*, 435-41 (1957) July.

Methods are shown for characterization of a mixture of hydrocarbons such as the ones present in petroleum or hydrogenated fuel and lube oils by only two indexes, density and the index of refraction. These simple methods are useful in production control. The nomograms for several special fractions are included. (See *Gas Abs. 10*, 198). G. Matus

Industrial Wastes

Mohler, E. F. Jr. and Jacob, L. N. DETERMINATION OF PHENOLIC-TYPE COMPOUNDS IN WATER AND INDUSTRIAL WASTE WATERS. COMPARISON OF ANALYTICAL METHODS. *Anal. Chem. 29*, 1369-74 (1957) September.

The five most widely used methods for determining small amounts of phenolic-type compounds in industrial waste waters have been evaluated. The 4-aminoantipyrine procedure is fastest, most precise, and most accurate even in the low parts per billion range. Ultraviolet absorption shows considerable promise for all phenolic-type compounds.

Mass Spectrometer

Crable, G. F. and Kerr, N. F. REACTION OF OXYGEN IN A MASS SPECTROMETER TO FORM CARBON MONOXIDE. *Anal. Chem. 29*, 1281, 82 (1957) September.

In an investigation of formation of carbon monoxide in the ion chamber of a mass spectrometer, it was found that carbon monoxide product was directly proportional to oxygen partial pressure. Carbon monoxide is believed to be formed by oxygen reaction with carbided filament.

Mud Analysis

Lamont, N. RELATIONSHIPS BETWEEN THE MUD RESISTIVITY, MUD FILTRATE RESISTIVITY, AND THE MUD CAKE RESISTIVITY OF OIL EMULSION MUD SYSTEMS. *J. Petrol. Tech. 9*, 51, 52 (1957) August.

An investigation was conducted on the resistivities of oil-emulsion muds, mud filtrates, and mud cakes to determine if these values conformed to the relationships for aqueous muds.

Oil Analyses

Linnard, R. E., Thrakeld, C. E. and Blades, R. T. PREVENTION OF DESTRUCTIVE ENGINE FAILURE BY SPECTOGRAPHIC OIL ANALYSIS. *Pipe Line News 29*, 70-74 (1957) August.

The application of the technique of emission spectrographic examination of used oil samples taken from stationary engines is described as a practical aid in controlling engine operations of the pipeline system. Occurence of abnormal events in the engine is indicated soon after engine distress or malfunctioning is first encountered, suggesting corrective action in advance of probable engine failure.

Oxygen Determination

Sheft, I. and Katz, J. J. DIRECT DETERMINATION OF OXYGEN IN ORGANIC COMPOUNDS. *Anal. Chem. 29*, 1322-25 (1957) September.

A fluorination procedure is used to determine oxygen directly in organic solid, liquid, or gaseous samples. Sample is shaken with BrF_2SbF_6 in a nickel reaction vessel at 500° C. Molecular oxygen, released by the reaction, is collected and measured in a vacuum system.

Siniramed, C. and Manci, C. CONTRIBUTO ALLA DETERMINAZIONE DIRETTA DELL'OSSIGENO NELLE SOSTANZE ORGANICHE E NEI CARBONI (ON THE DIRECT DETERMINATION OF OXYGEN IN SUBSTANCES AND COALS). *La Rivista Dei Combustibili* (Italian) *11*, 366-79 (1957) August.

For a direct determination of oxygen in organic substances, an apparatus was developed, according to Spooner. Efficiency and characteristics of the equipment were tested with various pure organic compounds. The blank run was made more reliable. Equipment procedure and results on technical products and coal are described.

Radioisotope Techniques

Boynton, S. D. RADIOISOTOPES . . . THE REFINER'S EVERYDAY TOOL. *Petrol. Processing 12,* 55-58 (1957) August.

The uses of radioisotopes as a fixed source of radiation are discussed and illustrated. Applications are demonstrated from the technical service division of Esso Standard Oil Co.'s refinery.

Putman, J. L. SOME APPLICATIONS OF RADIOACTIVITY IN THE PETROLEUM INDUSTRY. *J. Inst. Petrol. 43,* 215-26 (1957) August.

New techniques associated with artificial radioactivity have found important uses, especially in analysis and process control, in every industry. The petroleum industry makes use of these techniques, both in diversity and in applications. This review illustrates how radioactive methods are used in all phases of the industry, by means of selected examples.

Sulfur Determination

Hinsvark, Q. N. and O'Hara, F. J. DETERMINATION OF TOTAL SULFUR IN COMBUSTION AND DISODIUM ETHYLENEDIAMINE TETRA-ACETATE TITRIMETRIC METHOD. *Anal. Chem. 29,* 1318-22 (1957) September.

Sulfur at concentrations as low as 100 p.p.m. can be determined rapidly in a wide variety of petroleum products by aspirating the sample into an oxyhydrogen flame. Combustion products are drawn into a hydrogen peroxide scrubber. Sulfate is determined volumetrically by using EDTA to titrate excess of standard barium solution.

Jacobs, M. B., Braverman, M. M. and Hochheiser, S. ULTRAMICRODETERMINATION OF SULFIDES IN AIR. *Anal. Chem. 29,* 1349-51 (1957) September.

Total sulfides can be determined in the part per billion range in air by trapping in an alkaline suspension of cadmium hydroxide in a Greenburg-Smith impinger. Flow rates as high as one CF per minute can be used. Concentrations are estimated colorimetrically by the methylene blue method.

8. GENERAL AND PHYSICAL CHEMISTRY

Adsorption

Lakhanpal, M. L. and Flood, E. A. STRESSES AND STRAINS IN ADSORBATE-ADSORBENT SYSTEMS. IV. CONTRACTIONS OF ACTIVATED CARBON ON ADSORPTION OF GASES AND VAPORS AT LOW INITIAL PRESSURES. *Canad. J. Chem. 35,* 887-99 (1957) August.

When active adsorbents, such as active carbon and porous glass, adsorb relatively large quantities of vapors, normally the adsorption is accompanied by considerable swelling of the adsorbent. McIntosh, Yates and others observed that when the quantities adsorbed are small in some cases the adsorption is accompanied by an appreciable shrinkage of the adsorbent. The results of a theoretical and experimental study of this phenomenon are presented. It is suggested that the shrinkage is due to "bridging" of sites by adsorbate molecules, the "bridging" being associated with highly anisotropic forces acting on adsorbate molecules and with considerable tensile stresses along some of the bonds of the adsorbed molecules.

Peticolas, W. L. EFFECT OF ADSORBENT PERTURBATION ON B.E.T. THEORY. *J. Chem. Phys. 27,* 436-38 (1957) August.

The statistical mechanical derivation of the B.E.T. equation has been extended to include perturbations of the adsorbent by the adsorbate. The thermodynamic functions have been recalculated to include this effect. The thermodynamic functions for the adsorbent as well as the adsorbate have been calculated.

Author's Abstract

Catalysts

Long, F. A. APPLICATION OF ACIDITY FUNCTIONS TO THE MECHANISMS OF ACID-CATALYZED REACTIONS. *Proc. Chem. Soc.* (British), 220-25 (1957) August.

Although 25 years old there is a continuous interest in acidity and realization that there is a variety of definitions of acids. Application of acidity functions to the problem of mechanisms of acid catalysis is considered.

Selwood, P. W. THE MECHANISM OF CHEMISORPTION: ETHYLENE AND ETHANE ON NICKEL. *J. Amer. Chem. Soc. 79,* 3346-51 (1957) July 5.

Magnetization-volume isotherms were obtained for ethylene and ethane on a commercial nickel-kieselguhr catalyst, and on a coprecipitated nickel-silica catalyst, and also for hydrogen on a nickel surface already covered in part with chemisorbed ethylene, and for ethane on a surface already covered with hydrogen. On a coprecipitated catalyst at 100°C dissociative adsorption yields approximately a six-electron transfer per molecule of chemisorbed ethylene. Ethane at room temperature is chemisorbed nickel with somewhat more than a six-electron gain per molecule. Ethane is not chemisorbed on a nickel surface already covered with hydrogen.

Selwood, P. W. THE MECHANISM OF CHEMISORPTION: BENZENE AND CYCLOHEXANE ON NICKEL, AND THE CATALYTIC HYDROGENATION OF BENZENE. *J. Amer. Chem. Soc. 79,* 4637-40 (1957) September 5.

Magnetization-volume adsorption isotherms have been obtained for benzene and for cyclohexane on nickel-silica catalysts up to 150°C. Results also have been obtained for hydrogen admitted over pre-adsorbed benzene or cyclohexane, and vice versa. Benzene and cyclohexane are chemisorbed on nickel by a minimum six and eight site attachment, respectively. Chemisorbed benzene must be desorbed before hydrogenation.

Thomas, W. J. CHEMISORPTION OF ETHANE AT IRON AND NICKEL OXIDE. *Trans. Faraday Soc.* (British) *53,* 1124-31 (1957) August.

Sorption of C_2H_6 at supported and unsupported iron and nickel oxide shows that saturated hydrocarbons may be chemisorbed by both catalysts under different temperature conditions. Equilibrium and kinetic measurements throw light on the adsorption process, while the different adsorption characteristics at the two surfaces is discussed qualitatively in terms of covalent bonding to metal ions.

Compressibility

Harper, R. C. Jr. and Miller, J. G. COMPRESSIBILITY OF GASES. II. MIXTURES OF CARBON DIOXIDE AND HELIUM AT 30° C. *J. Chem. Physics 27,* 36-39 (1957) July.

An investigation of the compressibility factors of gaseous mixtures of CO_2 and He was conducted using the Burnett method. Results are expressed in an empirical regression formula from which approximations to the virial coefficient can be obtained. G. Matus

Equations of State

Pings, C. J. Jr. and Sage, B. H. EQUATIONS OF STATE. AN APPLICATION OF ORTHOGONAL POLYNOMIALS. *Ind. Eng. Chem. 49,* 1315-21 (1957) August.

An equation of state using open-ended series of orthogonal polynomials was developed. Coefficients of the resulting expansion are completely independent and were evaluated by the least squares methods. The proposed expansion describes the volumetric behavior of pure hydrocarbons in both liquid and gas phases within an accuracy comparable to that for experimental data available. The vapor pressure and critical properties may be predicted within an error of about three times the uncertainty inherent in experimental measurements.

Pings, C. J. Jr. and Sage, B. H. EQUATIONS OF STATE. APPLICATION OF ORTHOGONAL POLYNOMIAL EXPANSION TO PROPANE. *Ind. Eng. Chem. 49,* 1321-28 (1957) August.

A new equation of state involving orthogonal expansions with respect to temperature and reciprocal molal volume was applied to propane in liquid and gas phases. Coefficients of orthogonal polynomials from experimental data were determined by series expansion methods. The accuracy of prediction of the equation with experimental data was compared at a relatively large number of states. Such an equation can predict the volumetric behavior of propane in liquid and gas phases at pressures up to 10,000 pounds per square inch in the temperature range 40°-460° F. with an average error of 0.27%. Vapor pressure is described within twice the experimental uncertainty.

Author's Abstract

Equilibria

Atwood, K., Arnold, M. R. and Kindrick, R. C. EQUILIBRIA FOR THE SYSTEM, ETHANOLAMINES—HYDROGEN SULFIDE—WATER. *Ind. Eng. Chem. 49*, 1439-44 (1957) September, Part 1.

Equilibrium data are required to design equipment which uses ethanolamine solutions to remove hydrogen sulfide from gases. The three ethanolamines in solutions ranging from 5% to 50% of ethanolamine by weight were measured for partial pressures of H_2S between 5×10^{-4} mm. of mercury and eight atm., and temperatures between 80°-160° F. Ionization constants of the ethanolamines in this range are derived. A method interpolating and extrapolating the data is presented.

Nichols, W. B., Carmichael, L. T. and Sage, B. H. SUPERSATURATION IN HYDROCARBON SYSTEM. N-PENTANE IN THE LIQUID PHASE. *Ind. Eng. Chem. 49*, 1165-72 (1957) July.

Preliminary measurements were made to study the effect of strain on the behavior of pure n-pentane at temperatures of 160°-280° F. Results obtained by bubble formation permitted regression analysis of the data. The n-pentane measurements under nonequilibrium conditions indicate that bubble formation in a given volume of liquid at constant strain is a random process. The probability of bubble formation at 160°F. is much greater than at 280°F.

Fluidization Phenomena

Leva, M. CORRELATIONS OF THE DENSE-PHASE FLUIDIZED STATE AND THEIR APPLICATIONS. *Canad. J. Chem. Eng. 35*, 71-76 (1957) August.

A discussion of what is meant by quality of fluidization and a consideration of such phenomena as normal fluidization, slugging and channeling. Quantitative correlations that pertain to the prediction of the onset of fluidization, the state of bed expansion and some heat transfer characteristics of the fluidized dense state are presented.

Heat Capacity

Gambill, W. R. PREDICT HEAT CAPACITIES OF GASES. *Chem. Eng. 64*, 267-70 (1957) September.

Use is made of fundamental vibrational frequencies of bond types to help in rapidly estimating heat capacities of gases and vapors.

High-Vacuum Ionization

Yarwood, J. ULTRA-HIGH VACUA. *J. Scientific Instruments* (British) *34*, 297-304 (1957) August.

The use of the ionization gauge both as a pump and as a measuring instrument in the pressure range from 10^{-6} - 10^{-11} mm of mercury is discussed. Suggestions are made regarding the disparities between Alpert's results and those of other workers. The omegatron is described and also the factors which set the limit to the lowest pressures attainable in a glass envelope.

Hydrocarbon Spectra

Wilmshurst, J. K. and Bernstein, H. J. THE INFRARED AND RAMAN SPECTRA OF TOLUENE-α-d_3, *m*-XYLENE, AND *m*-XYLENE-$\alpha\alpha'$-d_6 *Canad. J. Chem. 35*, 911-25 (1957) August.

The infrared spectra of toluene, toluene-α-d_3 *m*-xylene and *m*-xylene-$\alpha\alpha'$-*d* have been obtained two to 30 μ for the vapors and liquids. The Raman spectra of the liquids have also been obtained photoelectrically together with depolization ratios. Vibrational assignments have been made for the four molecules consistent with vapor band contours, polarization data, the Teller- Redlich ratio rule, and a modified ratio rule due to Fitzer and Scott.

H_2S Dipole Movements

Rao, D. V. G. L. N. CALCULATIONS OF DIPOLE MOMENTS OF H_2S AND PH_3 *Trans. Faraday Soc.* (British) *53*, 1160-64 (1957) September.

Studies on dipole moments of the two isoelectronic molecules H_2S and PH_3 are presented. Effects of ionic character and *sp*-hybridization are considered, the hybridization parameters being determined by the orthogonality conditions. In both cases, lone-pair electrons make a significant contribution to the total dipole moment. The results of a molecular-orbital treatment are also outlined for H_2S.

Hydrogen Safety

Hayes, D. F. HYDROGEN. Safety & Fire Protection Tech. Bull. 5 (1956) August.

The author concludes that explosion is the main hazard of hydrogen. In air, gaseous hydrogen forms an explosive mixture in the range of 4.1 to 74.2 percent by volume. The liquid is hazardous because, due to evaporation, the gas is always present. A potentially large hazard exists if liquid hydrogen gets loose from the container. Safety rules in handling hydrogen are given.

Author's Abstract

Interface Scattering

Hurlbut, F. C. STUDIES OF MOLECULAR SCATTERING AT THE SOLID SURFACE. *J. Applied Physics 28,* 844-54 (1957) August.

Studies of molecular scattering at the gas-surface interface are described in which molecular beams of N_2 were scattered at surfaces of steel aluminum and glass. Surveys indicate the scattering to be well represented by a cosine distribution, but with moderate deviation in the case of glass-N_2 interaction. Measurements of scattering may be used to derive values of the momentum transfer coefficient to complete the calculation from scattering information alone. Assumptions must be made relating to the energy exchange.

Methane Ions

Lampe, F. W. and Field, F. H. REACTIONS OF GASEOUS IONS. III. FORMATION OF PROTONATED METHANE. *J. Amer. Chem. Soc. 79,* 4244, 45 (1957) August 5.

The formation of CD_4H^+ in mixtures of CD_4 with other hydrogen-containing substances has been observed. The formation of CD_4H^+ is first-order in CD^+_4 and first-order in the hydrogen-containing substance. Calculated rate constants relative to the rate constant taking $XH = CH_4$ for several such reactions are tabulated. (See also *Gas Abs. 13,* 200).

Radiation Reactions

Gordus, A. A. and Willard, J. E. GAS PHASE REACTIONS ACTIVATED BY NUCLEAR PROCESSES. *J. Amer. Chem. Soc. 79,* 4609-16 (1957) September 5.

Previous work shows that I^{128} and Cl^{38} activated by radiative neutron capture are able to replace hydrogen in organic compounds by unique processes. This work shows that: Br^{80} can undergo similar reactions, following either radiative neutron capture or isomeric transition; 2) all three halogens can replace hydrocarbon radicals as well as hydrogen atoms; 3) several modes of replacement are possible for reaction of a single type of halogen with a single type of target molecule; 4) the nature of the halogen has little effect on the activated atom, but has when activation is by isomeric transition; 5) tritium produced by the He^3 (n,p) H^3 process in gaseous hydrocarbons combines by a process similar to the halogen reactions.

Solubility

Clever, H. L., Battino, R., Saylor, J. H. and Gross, P. M. THE SOLUBILITY OF HELIUM, NEON, ARGON AND KRYPTON IN SOME HYDROCARBON SOLVENTS. *J. Phys. Chem. 61,* 1078-82 (1957) August.

The solubility of helium, neon, argon and krypton has been determined in 13 hydrocarbon solvents at three temperatures and a total pressure of one atmosphere. Heats and entropies of solution have been calculated and results compared with entropies. The solubilities have been correlated with solvent properties such as surface tension, solubility parameter and empty volume.

Davis, D. S. NOMOGRAM: SOLUBILITY OF WATER IN HYDROCARBONS. *Chem. Proc. Eng. 38,* 341 (1957) August.

A study of a recent compilation (Hoot, Azarnoosh and McKetta, *Petrol. Refiner 36* (1957) 255, May) on the solubility of water in hydrocarbons shows that the logarithm of the solubility in mole percent is linear with the reciprocal of absolute temperature. This relationship is the basis of an accompanying line coordinate chart.

Friend, L and Adler, S. B. CALCULATION OF LIQUID-VAPOR EQUILIBRIUM CONSTANTS FROM SOLUBILITY DATA. *Chem. Eng. Progress 53,* 452-58 (1957) September.

Confusion exists in the interpretation of the various methods used to express the solubility of a gas in a liquid solvent. The most frequently used solubility coefficients are defined and their limitations discussed. Examples are also given of how such data may be converted into the

more useful liquid-vapor equilibrium constants applied to multicomponent systems.

Loprest, F. L. A METHOD FOR THE RAPID DETERMINATION OF THE SOLUBILITY OF GASES IN LIQUID AT VARIOUS TEMPERATURES. *J. Phys. Chem. 61,* 1128-30 (1957) August.

Solubility data over a range of temperatures and a precision and accuracy of ± 1%. Method consists of the introduction of a measured quantity of gas into a constant volume system containing a known quantity of solvent and measuring the equilibrium pressure. The amount of solute gas in the gas and liquid phases then may be calculated. Systems were studied to test the apparatus: H_2 in n-heptane and CO_2 in water.

Solid Phases

Stevenson, R. SOLID METHANE—CHANGES IN PHASE UNDER PRESSURE. *J. Chem. Physics 27,* 656-60 (1957) September.

The solid phases of ordinary methane were studied under pressure at low temperatures by the volume discontinuity method. The phase diagram of the solid is presented. A new phase was observed, and the "missing" phase (by analogy to CD_4 and CD_3D) evidently appears only under pressure at liquid helium temperatures. Observations indicate another phase at high pressures in the low-temperature region. Indications of correlations among the phase diagrams of CH_4, CH_3D, and CD_4 are shown.

Stevenson, R. COMPRESSIONS AND SOLID PHASES OF CO_2, CS_2, COS, O_2, AND CO. *J. Chem. Phys. 27,* 673-75 (1957) September.
Compressions and phase diagrams for solid CO_2, CS_2, COS, O_2, and CO are presented for pressures up to 10,000 atmos. at low temperatures. A new modification of COS was observed under pressure.

Sulfur Dioxide

Mayhood, J. E. INFRARED INTENSITIES AND BOND MOMENTS IN SULFUR DIOXIDE. *Canad. J. Phys. 35,* 954-960 (1957) August.

New values have been obtained for the intensities of the three fundamentals of SO_2. Values are given for the bond moment derivatives and for the molecular dipole moments. The involvement of unshared electrons is suggested.

Synthesis Catalysts

Rapoport, I. B. and Muzovskaya, O. A. THE EFFECT OF ORGANIC SULFUR COMPOUNDS ON THE PROCESS OF SYNTHESIS OVER IRON CATALYSTS. *Khim. j. Tekh. Topliva i Masel* (*Chem. Teck. of Fuel & Oils*) (Russian), 19-27 (1957) No. 5.

Experimental results with sulfided Fe-Cu catalysts proved them stable for work with sulfur-containing synthesis gas.

Assoc. Tech. Services

Thermal Conductivity

Lenoir, J. M. EFFECT OF PRESSURE ON THERMAL CONDUCTIVITY OF LIQUIDS. *Petrol. Refiner 36,* 162-64 (1957) August.

A generalized empirical method to account for the effect of pressure up to 12.0 is presented. The method correlates the available thermal conductivity data with an average deviation of less than two percent.

Thermodynamics

Kolsky, H. G., Gilmer, R. M. and Gilles, P. W. ENERGY FUNCTIONS OF 54 GASEOUS ELEMENTS. *J. Chem. Phys. 27,* 494, 95 (1957) August.

Tables of the free energy functions of 54 elements, each considered as an ideal monatomic gas, were calculated using a Los Alamos Scientific Lab. IBM 704 computer for the temperature range 0°-8000° K.

Vapor Pressure

Maxwell, J. B. and Bonnell, L. S. DERIVATION AND PRECISION OF A NEW VAPOR PRESSURE CORRELATION FOR PETROLEUM HYDROCARBONS. *Ind. Eng. Chem. 49,* 1187-96 (1957) July.

A new, improved linear type hydrocarbon vapor pressure correlation has been developed for extrapolating beyond data limits. It has high precision for both pure hydrocarbons and narrow boiling mixtures.

Mottlau, A. Y. RAPID, PRECISE MICRO VAPOR PRESSURE METHOD. *Anal. Chem. 29,* 1196-2202 (1957) August.
A vapor pressure method has been developed, which in comparison with the Reid procedure,

gives a fivefold advantage in precision, a threefold advantage in speed, and requires a sample charge of only one ml. Results correlate with those from the Reid.

9. ORGANIC CHEMISTRY AND PETROCHEMICAL

Acetylene

Frevel, L. K. and Dressley, L. J. (assigned to The Dow Chemical Co.) SELECTIVE HYDROGENATION OF ACETYLENE IN ETHYLENE AND CATALYST THEREFOR. U. S. 2,802,889 (1957) August 13.

The invention claims the selective hydrogenation of acetylene in the presence of ethylene with a supported palladium catalyst modified with one to 40 parts of gold, silver or copper.

Lemke, C. H. (assigned to E. I. du Pont de Nemours and Co.) PRODUCTION OF SODIUM CARBIDE, U. S. 2,802,723 (1957) August 13.

This invention claims the method of forming sodium carbide which comprises reacting a mixture containing free sodium hydroxide and free carbon at a temperature of around 700°-900° C, the free carbon being in excess of the stoichiometric requirement for formation of carbide from the sodium hydroxide.

Shevchuk, V. U. PRODUCTION OF ACETYLENE BY OXIDATION-PYROLYSIS OF METHANE IN PRESENCE OF HYDROGEN. *Gasovaya Promysh.* (*Gas Ind*) (Russian), 32-37 (1957) No. 7.

The influence of the factors of temperature, residence time, surface to volume ratio in reactor, composition of initial gas mixture, and added hydrogen were investigated for the process of acetylene production by the oxidation-pyrolysis of methane. Presence of hydrogen reduces CO formation and increases acetylene yield. External heat supply will reduce oxygen required by 2.2 moles per mole of acetylene. Use of coke-oven gas or recirculated product gas is suggested as a source of hydrogen. Material balance is given by the equation:

$$20CH_4 + 10\ O_2 + 10H_2 = 0.6\ CO_2 + 4.3\ C_2H_2 + 0.1\ C_2H_4 + 7.4\ CO + 3.2\ CH_4 + 11.4\ H_2O + 28\ H_2$$

J. W. Penney

Ethylene

Bogart, M. J. P. (assigned to The Lummus Co.) PRODUCTION OF OLEFINS. U.S. 2,796,951 (1957) June 25.

In the conversion of paraffins to olefins and acetylene, fractionation followed by solvent extraction with specified solvents is claimed for affecting separation of the product components into pure fractions.

J. E. Kennedy

Fair, J. R., Mayers, J. W. and Lane, W. H. COMMERCIAL ETHYLENE PRODUCTION BY PROPANE PYROLYSIS IN A MOLTEN LEAD BATH. *Chem. Eng. Progress 53,* 433-38 (1957) September.

Results of a plant-scale research program on commercial ethylene production by propane and propane-propylene pyrolysis in a molten lead bath indicate that: 1) the molten lead bath is a convenient means for transferring heat at moderately high temperatures; 2) propane pyrolysis in a lead-bath unit yields the same product distribution as propane pyrolysis in a tubular reactor; 3) heat transfer between molten lead and its agitating gas is quite high; and 4) mechanical problems involved in operating a lead-bath unit are not great.

PROCESS UNION BEGETS LOW-COST ETHYLENE. *Chem. Eng. 64,* 158-60 (1957) August; *Chem. Week 80,* 96, 98, 100 (1957) June 22.

The concept of ethylene recovery from oil-gas production is treated on a year-round basis. Stark's recovery process (U.S. 2,714,060) has operated three years at a six mill. CF per day oil-gas plant. Compared to Kellogg's pyrolysis, Stark claims it will lower the price of ethylene from 4-1/3 to 1-1/4 cents/lb.

HCN Manufacture

Inman, B. N. (assigned to E.I.duPont de Nemours and Co.) MANUFACTURE OF HYDROGEN CYANIDE. U. S. 2,803,522 (1957) August 20.

In vapor-phase reaction between air, ammonia and gaseous hydrocarbons, the reactants are mixed above 60° C to avoid carbonate formation, then filtered and reacted on a Pt catalyst to form HCN.

Hydrocarbon Cracking

Calderbank, P. H., Hovnanian, V. P. and Tal-

bot, F. D. THE AUTOTHERMIC CRACKING OF LIGHT HYDROCARBONS. *J. Appl. Chem.* (British) *7*, 425-31 (1957) August.

Experimental work is described in which ethane and propane have been autothermally cracked by admixture with air in a reactor packed with alundum spheres. It is possible to predict the performance of such a reactor operating under varying air to gas ratios and feed rates. These predictions are in agreement with experimental findings and with established rates of combustion. Such calculations should be of value in assessing the economics of large-scale operations.

Oxidation Process

Anisonyan, A. A., Gudkov, S. F., Enikolopyan, N. S., Kleimenov, N. A., Markevich, A. M., Nalbandyan, A. B., and Sidorov, A. P. PRODUCTION OF FORMALDEHYDE BY DIRECT OXIDATION OF NATURAL GAS WITH OXYGEN OF THE AIR. *Gasovaya Promysh.* (*Gas Ind.*) (Russian), 32-39 (1957) No. 6.

Pilot plant operation is described for production of formaldehyde by incomplete oxidation of natural gas by oxygen of the air in the presence of nitric oxide. Plant capacity 150 m^3 of gas-air mixture/hr; formaldehyde yield with single pass 2.5%, with six-pass recirculation 10.6% by volume based on methane used; reactor volume 17 liters, reactor filled with Raschig rings pretreated with calcium tetraborate, reactor temperature 680°C, residence time 0.15 sec, NO content 0.13%, formaldehyde removed by scrubbing with formalin at 7°-9°C, product 40% by weight. An industrial plant is being built based on experience with this pilot plant.

J. W. Penney

Lake, W. C. (assigned to Pan American Petroleum Co.) PROCESS FOR PARTIAL OXIDATION OF HYDROCARBONS. U. S. 2,801,260 (1957) July 30.

The proportion of one of the oxygenated compounds from the group of formaldehyde, acetaldehyde, acetic acid, methanol and ethanol present in the vapor phase oxidation products of hydrocarbons may be enhanced by holding the product mixture at certain conditions of hydrogen pressure (0.0001 - 100 atm.) and temperature (425°-1000° F) to attain a favorable equilibrium, then quenching.

Sulfur Adducts

Dinerstein, R. A. (assigned to Standard Oil Co.) UREA ADDUCTS OF ORGANIC SULFUR COMPOUNDS. U. S. 2,804,451 (1957) August 27.

Normal organic sulfides, disulfides and mercaptans with six carbon atoms or more in the molecule may be separated from lower carbon-sulful compounds by forming a crystalline adduct with urea (one mole per CH_2 group in extractable material), filtering, washing and recovering by recomposing adduct with water.

Synthetics from Coal

DOUBLE VOTE OF CONFIDENCE IN COAL. *Chem. Week 81*, 80, 82-84 (1957) August 10.

Koppers new commercial niacin plant and coal-tar development unit in Arroyo, W. Va. represents an investment of more than $2 million in an initial venture into the pharmaceutical field. This is a 500,000 lbs./year plant for the production of the niacin from quinoline. A one-ton/day semiworks plant employing new separating techniques will fractionate creosote.

10. CHEMICAL ENGINEERING

Absorption Columns

Minard, G. W. and Winning, M. D. FLOODING PHENOMENA IN PACKED GAS ABSORPTION COLUMNS. *Can. J. Chem. Eng. 35*, 39-46 (1957) June.

A new relationship depending on gas flow rate, liquid flow rate and fluid properties was developed to correlate pressure-drop observations.

R. T. Ellington

Cost Analyses

Jelen, F. C. CONSIDER INCOME TAX IN COST ANALYSES. *Chem. Eng. 64*, 271-76 (1957) September.

A method for making comparative cost analyses based on capitalized costs with income tax for the purchase of equipment is presented.

Fixed-Bed Reactors

Lapidus, L. FLOW DISTRIBUTION AND DIFFUSION IN FIXED-BED TWO-PHASE REACTORS. *Ind. Eng. Chem. 49*, 1000-06 (1957) June.

The internal pore structure and column-packing performance were studied in tracer time-of-

contact experiments. Flow distribution under a variety of conditions approximates plug flow. Packing porosity is important and may lead to skewed time-of-contact curves. The results are related to actual operation in petroleum hydrogenation processes. E. B. Shultz

Leva, M. CORRELATIONS IN FIXED BED SYSTEMS. *Chem. Eng. 64,* 245-48 (1957) September.

This article presents information on the following topics: how to predict pressure drop by means of a Kozeny-Carman type equation; how to handle pressure drop when compressible fluids flow through reactor beds; and how step-by-step analysis enables calculation of power requirements for fluid circulation.

Flow Sheets

O'Donnell, J. P. HOW FLOWSHEETS COMMUNICATE ENGINEERING INFORMATION. *Chem. Eng. 64,* 249-66 (1957) September.

The group of flowsheets shown includes the heat and material balance, the process, the process control and the plot plan. These four tell the "what and why" of the scheme. Other flowsheets in the group include: the process piping, the instrument, the utility and the electrical. These tell how to apply the process scheme to a specific plant installation.

Fluid Flow

Metzner, A. B. NON-NEWTONIAN FLUID FLOW—RELATIONSHIPS BETWEEN RECENT PRESSURE-DROP CORRELATIONS. *Ind. Eng. Chem. 49,* 1429-32 (1957) September, Part 1.

The applicability of the generalized Reynolds number to Bingham plastic and "power-law" non-Newtonian flow is shown in detail. This analysis supports the utility of this dimensionless group. Mathematical relationships between the fluid property parameters in the generalized Reynolds number and the corresponding descriptive parameters Bingham plastics have been derived.

Fluidization

Johnson, W. B. (assigned to The M. W. Kellogg Co.) CONTACTING SOLIDS AND GASES. U.S. 2,799,359 (1957) July 16.

Contact material in the form of granular masses flowing downwardly through a reaction zone is transported for further treatment, or returned to top of reaction zone by removing it from reaction zone, mixing with more finely divided material to form a fluidizable mixture which is then movable to upper levels by a secondary fluidizing gas stream, whereupon the finer materials and secondary gas are readily removed.

Leva, M. FLOW BEHAVIOR IN FLUIDIZED SYSTEMS. *Chem. Eng. 64,* 289-95 (1957) October.

The characteristics of the fluidized state and the requirements for achieving it are described and illustrated. Fluidization has the following advantages: 1) continuous operation; 2) flat temperature profiles; 3) high heat transfer coefficients; 4) relatively low pressure-drops through fluidized beds; and 5) savings effected in catalyst preparation since no definite shapes are required for fluidization. The influence of deviations from ideal behavior on flow relations are discussed.

Zenz, F. A. CALCULATE FLUIDIZATION RATES. *Petrol. Refiner 36,* 147-55 (1957) August.

This review of the effects of variables leading to particulate and aggregative fluidization presents a chart for computing fluidization rates and the velocity-bed density relationship for the particulate mode.

Gas-Solids Flow

Eastwood, S. C. (assigned to Socony Mobil Oil Co., Inc.) PROCESS FOR HYDROCARBON CONVERSION. U. S. 2,798,029 (1957) July 2.

Uniform flow distribution across a downwardly moving bed of granular contact material is claimed by the method of contact material and fluid stream introduction described. The result should be a more uniform temperature distribution across the bed which would lead to improved conversion of the reactants. J. E. Kennedy

Mehta, N. C., Smith, J. M. and Comings, E. W. PRESSURE DROP IN AIR-SOLID FLOW SYSTEMS. *Ind. Eng. Chem. 49,* 986-92 (1957) June

Pressure drop was measured for the vertical

and horizontal transport of glass beads with air in a standard half-inch pipe. Two sizes of microspheres were used, having average diameters of 97 and 36 microns. Average particle velocity data were also obtained over a range of air velocities and solid flow rates. The results of both pressure drop and particle velocity measurements suggest that the flow pattern of the solid particles changes with their size.

Heat Transfer

Buthod, P. HOW TO ESTIMATE PRESSURE DROP IN HEATERS. *Oil Gas J. 55,* 111-18 (1957) July 1.

In this new calculation technique a family of enthalpy lines is superimposed on the phase diagram of the stock being vaporized. Then a continuous heat balance can be run while making a graphical integration to evaluate the pressure vs. length curve. G. Matus

Hydrocarbon Decomposition

Berger, C. V. and Appell, H. R. DECOMPOSITION OF HYDROCARBONS: PYROLYTIC AND CATALYTIC. UNIT PROCESSES REVIEW. *Ind. Eng. Chem. 49,* 1478-84 (1957) September, Part 2.

With the introduction of platforming late in 1949, platinum catalyst reforming capacity has increased about 250% per year for seven years. Catalytic cracking has a steady growth, showing an increase of about seven percent during 1956. Commercial two-stage catalytic cracking gives higher yields of a more olefinic gasoline. Noncatalytic new commercial activity has been in severe thermal cracking for the producting of olefins for chemicals. Serious investigations have begun on high energy irradiation.

Hydrogen Liquefaction

Chelton, D. B., Macinko, J. and Dean, J. HYDROGEN LIQUEFACTION BY A DUAL PRESSURE PROCESS. *Refrig. Eng. 65,* 39-41, 62 (1957) August.

By a dual pressure process liquid hydrogen can be produced economically and simply. At optimum conditions the energy required to liquefy hydrogen by this method is 2.44 hp-hr per gal while operating with an expansion valve and 1.78 hp-hr per gal while operating with an expansion engine. These values do not include the energy required to produce the liquid nitrogen used for precooling the high pressure hydrogen. Authors' Abstract

Hydrogenation Processes

Bradbury, J. T. HYDROGENATION AND HYDROGENOLYSIS. UNIT PROCESS REVIEW. *Ind. Eng. Chem. 49,* 1523-31 (1957) September, Part 2.

Literature available in 1956 covered hydrogenation of carbon oxides, oxo synthesis, ammonia synthesis, hydrogenation of oils and fats, hydrogenation af acetylenes, olefins, and aromatic hydrocarbons, hydrogenation of petroleum coal, and related materials, hydrogenation of organic compounds, and fundamental studies on hydrogenation catalysts. The review is arranged in tabular form.

Industrial Water

Fiedler, A. G. KEYS TO AMPLE GROUND WATER FOR THE FUTURE. *Chem. Processing 20,* 38, 39, 295, 96 (1957) September.

As industrial and population centers grow our nation is approaching the limit of supply of good industrial water from underground sources even though huge underground reservoirs remain to be tapped. Access to ground water is a big factor in decentralization of industry.

Mass Transfer

Mathers, W. G., Madden, A. J. Jr. and Piret, E. L. SIMULTANEOUS HEAT AND MASS TRANSFER IN FREE CONVECTION. NUMERICAL SOLUTIONS FOR A VERTICAL PLATE AND EXPERIMENTAL RESULTS FOR SPHERES IN GASES. *Ind. Eng. Chem. 49,* 961-68 (1957) June.

Numerical solutions for the basic equations for simultaneous heat and mass transfer from a vertical plate to a fluid in free convection were obtained by using an analog computer. The partial solutions neglect inertia terms and should apply more accurately where the fluid is a liquid.

Nuclear Processing

Burril, E. A. IONIZING RADIATIONS. *Chem. Eng. 64,* 235-41 (1957) September.

High-speed electrons and other ionizing radiations are now in the processing picture. A discussion on their position today, their production, use and economics is given.

Oxygen Production Plant

LARGE STEEL MILL OXYGEN PLANT. *Ind. Heating 24*, 1742, 44, 46, 48 (1957) September.

The largest single-unit oxygen producing plant for steel mill service is now in operation at Duquesne, Pa. Built and owned by Linde Co., the plant has a rated capacity of over 500 tons of oxygen per day. About 90% of the oxygen is being utilized to increase output and reduce fuel consumption in ferro-manganese blast furnaces.

Process Cost Control

Nitchie, E. B. HOW TO BUILD PROCESS COST CONTROL SYSTEMS FOR CHEMICAL OPERATIONS OF ALL TYPES. *Chem. Eng. 64*, 233-48 (1957) October.

Chemical engineers and managers must know some of the skills of cost accounting, industrial engineering and other techniques of management to do the following: 1) reduce cost and increase profits; 2) maintain a set cost level for process operations; 3) forecast with more accurate cost information; 4) establish new product prices with confidence; 5) determine when to replace equipment more exactly; 6) decide when to decentralize from accurate data; and 7) evaluate personnel on basis of cost performance.

Separation Methods

Jones, A. L. THERMAL DIFFUSION GETS ATTENTION. *Petrol. Refiner 36*, 153-57 (1957) July.

First used as an analytical tool, this new method may lead to a commercial separation technique for refining petroleum fractions.

Author's Abstract

Smith, E. E. and Fleming, C. E. HERE'S DATA ON PROPANE FRACTIONATION. *Petrol. Refiner 36*, 141-44 (1957) July.

Separating hydrocarbons according to their solubility in liquid propane is discussed. Data are compared with separation by distillation.

Author's Abstract

EXAMINE THESE WAYS TO USE SELECTIVE ADSORPTION. *Petrol. Refiner 36*, 136-40 (1957) July.

A zeolite molecular sieve adsorbent is used to selectively remove CO_2 from ethylene, water and H_2S from natural gas, and n-paraffins from mixed streams containing isomers and cyclics to upgrade gasoline stocks. Selective removal depends upon molecular size and polarity which allows adequate separation of narrow boiling range constituents.

P. B. Tarman

Thermometer

White, G. K. and Woods, S. B. INDIUM RESISTANCE THERMOMETER: 4°-300° K. *Rev. Sci. Instruments 28*, 638-41 (1957) August.

The possible advantages are discussed of a resistance thermometer made with a metallic indium element of low Debye characteristic temperature of 3.41°K and very high purity.

Waste Gases

Ruff, R. J. PROFITS FROM WASTE GASES. *Chem. Eng. Progress 53*, 377-80 (1957) August.

What today are frequently considered "waste-gases" from the manufacture or processing of chemicals may well be the source of vast quantities of energy, now recoverable through catalytic oxidation. Increased operating profits resulting from utilization of this energy may be the determining factor in the installation of air corrective equipment. Operations in the manufacture of chemicals where the catalytic fume combustion process may serve the dual role of profitable energy recovery and air pollution control are outlined.

Water Storage

Dlesk, R. R. THE STORAGE OF HIGH PURITY WATER. *Corrosion 13*, 585t-88 (1957) September.

As the purity of water increases, the storing of it becomes an increasingly difficult problem. New protective measures for existing steel tanks were made. Protective coatings discussed include red lead paint, metallic zinc paint, synthetic rubber, nickel-phosphorous-alloy coating, heavy electroplated nickel, and metallized aluminum coatings. Aluminum, as a construction material for storage facilities, was evaluated in tests.

Water Treatment

Fielden, T. B. PREVENTION OF CORROSION BY WATER TREATMENT. *Corrosion Tech.*

(British) *4*, 225-29 (1957) July.

A summary of methods used to prevent corrosion in boiler plants and water cooling systems containing brief discussion of the fundamentals of corrosion in aqueous media. Reference to 33 technical articles is made. G. G. Wilson

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Computer

Bruce, W. A. ELECTRONIC COMPUTERS' MAGIC TALENTS SPEED IMPROVED PRODUCTION TECHNOLOGY. *Oil Gas J. 55*, 110-14 (1957) June 3.

Among the problems a computer is able to solve are: 1) predicting influx of water into a reservoir; 2) determining oil displacement by water or gas; 3) predicting oil-gas phase behavior; 4) analyzing seismic reflection-time data; and 5) improving the odds of oil finding.

Franks, J. J. THOROUGH INVESTIGATION SHOWS PIPELINE HOW TO USE COMPUTER TO ADVANTAGE. *Gas 33*, 115-19 (1957) September.

Experience with a Burroughs Corp. Datatron and training of Northern Natural Gas Co. computation personnel is described. Data processing, programming and systems work are discussed in relation to gas measurement and accounting and to pipeline design.

McIntire, R. L. USING ELECTRONIC COMPUTERS IN THE OIL INDUSTRY. *Oil Gas J. 55*, 158 (1957) May 27.

An ideal example of the isothermal flash calculations performed with an electronic computer are presented showing how electronic computers can be used to solve trial and error problems for the refinery technologist.

G. Matus

Stormont, D. H. NEW DIGITAL IS ESPECIALLY DESIGNED FOR PROCESS CONTROL. *Oil Gas J. 55*, 151, 52 (1957) September 2.

A new digital control computer, specifically designed for automatic control, is scheduled to be incorporated into the control setup of a refinery process by Ramo-Woolridge Corp. Its features, cost and functions are described.

Dust Collection

Lunde, K. E. and Lapple, C. E. A CRITIQUE ON THE STATE OF THE ART OF DUST AND MIST COLLECTION. *Chem. Eng. Progress 53*, 385-91 (1957) August.

This article summarizes the basic performance of principles of dust collection equipment, discusses the major problems in measurement techniques and indicates areas for potential development.

Fire Safety

Risinger, J. L. CONTROLLING FIRES OF HIGH VAPOR PRESSURE LIQUIDS. *Pipe Line Ind. 7*, 51-53 (1957) September.

This is a series of case histories pointing up the requirements of handling liquids with high vapor pressures.

Fluid Metering

Lynch, E. B. and Schoenberg, J. EQUATIONS SIMPLIFY FLUID METERING. *Chem. Eng. 64*, 259-62 (1957) August.

Equations are given which determine the size and cost of the most efficient differential producer for metering in cases of: 1) volume flow of ambient temperature liquids; 2) mass flow of non-ambient temperature liquids; 3) mass flow of gases; and 4) volume flow of gases.

Gas Density

Jarry, R. L. ALL METAL APPARATUS FOR THE DETERMINATION OF THE DENSITY OF LIQUIFIED GASES. *Rev. Sci. Instruments 28*, 641, 42 (1957) August.

An all-metal apparatus designed for density measurements on liquefied gases is described. The metal construction enables its use with corrosive materials, and also allows measurements up to moderate pressures. It consists of a pycnometer, temperature control device and gas handling system. Though particularly designed for density work it serves for vapor pressure determinations with slight modification. The design and its use with liquid fluorine is outlined.

Maintenance

Baumann, F. L. WHEN TO REPLACE CONSTRUCTION EQUIPMENT ON A SPREAD? *Pipe Line Ind. 7*, 36-40 (1957) September.

The article discusses the problem of finding how long a piece of equipment can be kept in service

economically. The METRE (most economical time to replace equipment) system has been developed which utilizes the owning and operating costs of individual machines. After a discussion of the factors to be considered the following five steps were listed and explained: 1) hourly cost of major repairs and overhauls; 2) hourly charge of old machine's diminishing productivity; 3) hourly cost for old machine's diminishing availability; 4) hourly charge for capital decline; and 5) most economical time to replace equipment.

Tate, R. L. LIGHTING IN GASWORKS. *Gas J.* (British) *291*, 445, 46, 55, 56, 61 (1957) August 28.

Lighting requirements in a gasworks installation are divided into four main categories, according to the work and the fire-and-explosions risks: 1) office, laboratories, etc.; 2) external industrial areas; 3) retort houses; and 4) hazardous areas. Individual requirements for these are discussed.

SERVICE MANUALS FOR YOUR SHOP. SECTION THREE: EQUIPMENT MAINTENANCE GUIDE. *Construction Methods Equip. 39*, 229-68 (1957) July.

A comprehensive listing of equipment manuals is offered to the construction industry.

Author's Abstract

Nomographs

Hare, N. ALIGNMENT CHARTS AND GRAPHICAL AIDS FOR USE IN THE CONTROL OF PRODUCTION PROCESSES—PARTS 1, 2, 3,. *Gas World* (British) *146*, 258-61 (1957) August 10; *Ibid.* 295-99 August 17; *Ibid.* 340-42 August 24; *Gas Times* (British) *91*, 462-64, 68 (1957) August 16.

Alignment charts and graphical methods for obtaining the information needed in controlling gas manufacturing processes are presented, and their applications are discussed. These include estimation of gas and coke yield from a coal, dry coke and breeze yields, hydrocarbon enrichment value (H.E.V.) and gas inerts, sensible heat in coke and steam decomposition, steam from waste heat boilers per lb-C in producer gas, carbon loss in producer ash, therms in producer gas vs. oil used and inerts, water required for ammonia washing, scrubber performance and material cost per therm of gas.

Plant Design

Woodruff, E. B. THE BURNING QUESTION—STEAM PLANT DESIGN. *Coal Utilization 11*, 27-31 (1957) August.

Before actual steam plant design can begin many factors must be considered, if the new construction is to be satisfactory. For the renovation of old steam plants, a different set of factors must be examined. However, the end result must be the same for both new plant design and old plant modernization—satisfaction, efficient operation, and reasonable cost.

Pressure Gage

Edwards, P. L. HIGH-SPEED HIGH-PRESSURE GAGE. *Instruments & Automation 30*, 1504-06 (1957) August.

The Naval Ordnance Lab. has a program to determine the PVT relationships of some gases at high temperatures and pressures—up to 4000°K and 100,000 psi—where drastic requirements must be met with regard to gage performance. After a study, the design of a quartz crystal piezoelectric strain gage was selected for development.

Pump Seals

Woodhouse, H. CENTRIFUGAL PUMP PACKINGS AND SEALS. PART 5: PACKING MAINTENANCE. *Petrol. Refiner 36*, 193-97 (1957) June; *Pipe Line Ind. 6*, 55-58 (1957) June.

Included in this report on installation and maintenance is a guide to packing troubles, their cause and cure.

Author's Abstract

Radiometry

Eppley, M. and Karoli, A. R. ABSOLUTE RADIOMETRY BASED ON A CHANGE IN ELECTRICAL RESISTANCE. *J. Optical Soc. Amer. 47*, 748-55 (1957) August.

A blackbody and an electrical method of absolute radiometry are described. The blackbody is an electrically heated tubular furnace. The radiometer consists of a platinum wire coil on a blackened, silver disk electrically insulated but in good thermal contact. Change in resistance of the coil is a measure of the radiation absorbed. By heating the coil electrically, the energy required to produce this change is readily calculated. The radiant flux emitted by the

above source is within 1% of that from such an ideal blackbody at temperatures of 800°-1100°C.

Shop Equipment

WHO MAKES SHOP EQUIPMENT? *Construction Methods and Equipment 39,* 134-60 (1957) July.

The manufacturers who produce the various types of shop tools for contractor's use are listed.

Steam Measurement

Potter, J. H. STEAM CALORIMETRY. *Combustion 29,* 51-55 (1957) July.

The art and science of steam calorimetry is reviewed. Descriptions and equations are presented for the principal types of steam calorimeters. The importance of calorimetry is considered in terms of industry and engineering education. R. T. Ellington

12. MATERIALS OF CONSTRUCTION, AND CORROSION

Cathodic Protection

Ballou, J. K. and Schremp, F. W. CATHODIC PROTECTION OF OIL WELL CASINGS AT KETTLEMAN HILL, CALIFORNIA. *Corrosion 13,* 507t-14 (1957) August.

Cathodic protection tests on three oil well casings at Kettleman Hills, Calif. showed that this is a practical method of controlling external casing corrosion at least to depths of 8,000 ft. Inexpensive surface measurements of casing potentials can be used to indicate the degree of protection.

Morgan, J. H. ZINC ANODES FOR CATHODIC PROTECTION. *Corrosion Tech.* (British) *4,* 272-74 (1957) August.

Historically zinc was first used to provide cathodic protection to warships over a century ago. The benefit that proper protection might bring to ships and other metal structures became apparent just prior to, and during the last war. To achieve this protection, modified metal was necessary to keep the anode electrochemically active, and engineering of the anode shape, size and disposition was needed. A suitable zinc alloy provides a valuable sacrificial anode material and offers considerable advantages over magnesium.

APPLICATION OF ZINC ANODES TO GAS DISTRIBUTION SYSTEMS. *Gas Age 120,* 18-22, 58 (1957) July 25.

Zinc anodes are used in applying cathodic protection to distribution systems in congested areas since it is possible to minimize interference effects on other piping and cable systems. They may be placed close to or underneath the pipe so that a minimum of excavation is necessary. The difficult problem is that of insulating the distribution system from other underground structures.

CATHODIC PROTECTION OF STEEL UNDERGROUND. *Corrosion Tech.* (British) *4,* 275, 76 (1957) August.

Underground corrosion of steel pipe costs $600 million annually, in the United States. Corrosion can be greatly reduced by cathodic protection techniques, in which the structure is maintained at a suitable negative electrical potential.

Ceramics

Koenig, J. H. and Smoke, E. J. RECENT TECHNICAL DEVELOPMENTS IN CERAMICS AND REFRACTORY MATERIALS. Part 1. *Ind. Heating 24,* 1623, 24, 26, 28, 30, 32 (1957) August; Part 2. *Ibid.* 1851-52, 54, 56 September.

Recent technical developments in the field of ceramics are reviewed. These include: glass, coatings, refractories, cermets, electronic ceramics, mechanical ceramics, with discussion of engineering and service properties, principal and potential areas of application.

Coatings

Blain, H. M. NEW ORLEANS: JOINTS COATED FROM INTERIOR. *Amer. Gas J. 184,* 17-19 (1957) July.

Preventing and eliminating gas leakage by internal coating of large-diameter piping has been successfully accomplished with the epoxy resin coating of 34 joints in a 30-in. cast iron utilization pressure main in New Orleans. Special ventilating, cleaning and coating built in company shops section is illustrated.

Stegner, A. L. and Baxter, J. B. BUILT-IN

ANODES PROTECT SUBMARINE LINE. *Pipe Line Ind. 7,* 28-31 (1957) September.

Anode clamps are described as bolted to pipeline and buried while laying to protect the center 10 miles of 21-mile line without future maintenance.

Edwards, C. R. and Jenkins, E. MINISTRY OF SUPPLY OUTDOOR EXPOSURE STATION, GLASCOED, WALES. TESTING PAINTS BY OUTDOOR EXPOSURE. PART 1. *Corrosion Tech.* (British) *4,* 192-94 (1957) June; PART 2. *Ibid.* 245-50 July.

The inland exposure site at Glascoed is described in Part 1. Rack layout, panel fittings, trailer laboratory and equipment are outlined. The methods of assessing the performance of coated test panels included in outdoor exposure tests at this exposure station are discussed in Part 2. The primary types of failure considered are loss of gloss, color change, chalking, checking and cracking, flaking, blistering, rusting, dirt collection, water spotting and erosion. Illustrations of the record forms and of types of failure are included.

Fabian, R. J. ZINC-RICH PAINTS PROTECT IRON AND STEEL PARTS. *Materials and Methods 46,* 102-04 (1957) July.

Ferrous surfaces can be galvanized by simply painting with a suspension consisting mainly of metallic zinc.

Parker, M. E. AN EVALUATION PROGRAM FOR SERVICE LINE COATING. *Gas 33,* 35 (1957) July.

A brief outline of a field test program that could be used by a gas distribution company to evaluate different types of service pipe coatings.

G. G. Wilson

Rawlings, E. G. CORROSION-RESISTANT COATINGS, NATURAL, CHLORINATED AND SYNTHETIC RUBBER. *Corrosion Tech.* (British) *4,* 283-86 (1957) August.

Natural and synthetic rubber linings have been used for many years for the protection of tanks and chemical plant. Types mentioned illustrate the part played by natural and synthetic rubber in the field of protective coatings.

Riley, M. W. THE FLUORO-ELASTOMERS: LATEST WEAPON AGANST HEAT AND FLUIDS. *Materials and Methods 46,* 90-98 (1957) July.

This report compares and summarizes data just released on the five fluorinated elastomers, the newest family of rubber developed to withstand corrosive fluids and extremes of temperature.

Teel, R. B. and Fair, W. F. Jr. TESTING OF COAL TAR COATINGS—RESISTANCE TO FOULING AND DEGRADATION BY MARINE ORGANISMS. *Corrosion 13,* 491t-500t (1957) August.

Extensive data are given showing the resistance of coal tar and asphalt enamels to barnacle penetration, the resistance of experimental coatings systems to barnacle penetration, the effect of toxic, toxic pretreatment and vehicle on the anti-fouling properties of coal tar base coatings, the influence of barrier and anti-fouling performance, and fouling ratings of tar base coatings during exposure to sea water.

FIREPROOFING, INSULATING STORAGE TANKS. *Amer. Gas. J. 184,* 37 (1957) August.

Storage tanks of all sizes can be protected from fire and evaporation loss with a perlite insulating concrete. Adaptable in plants where oil is stored for use in gas manufacture, it can also protect LPG storage tanks. Application is illustrated at a Philadelphia plant.

Corrosion

Bass, D. and Sindery, G. G. CATIONIC CHEMICALS IN STEAM PLANT. *Corrosion Tech.* (British) *4,* 230-34 (1957) July.

The use of "filming" amines, especially octadecylamine, to prevent steam plant condensate line corrosion is discussed with a brief section on the causes and general methods of prevention. Methods of injection and control, test results, and examples of costs of treatment and examples of costs and savings accomplished by use of this material are the primary topics considered.

G. G. Wilson

Fair, W. F. Jr. CORROSION. TRAINING AND TRENDS. *Chem. Processing 20,* 38, 39, 89-91 (1957) July.

The cost of corrosion may rise even further if management neglects proper planning for cor-

rosion mitigation. Improved facilities for training of corrosion engineers are needed so that chemical processing plants will take full advantage of services and products offered by companies in the corrosion control field.

Morlet, M. J. and Geoffray, C. CONTRIBUTION TO THE STUDY OF INTERNAL CORROSION. *Gas J.* (British) *291*, 332-34 (1957) August.

A continued report on the corrosive action of certain constituents of town gas on the mild steel used in mains and pipes. Work included: the corrosion of steel in an atmosphere of synthetic gas saturated with water; whether observations relative to synthetic gases could be transposed to purified town gas; the influence of temperature on the speed of attack on the steel; and the influence of pressure on the corrosion phenomena.

Tandy, E. H. CORROSION IN LIGHT OIL STORAGE TANKS. *Corrosion 13*, 427t-32t (1957) July.

The most important factors governing corrosion rates in oil storage tanks are solubility of oxygen in the oil, rate of working, type of roof used, vapor pressure of the oil and location of the tank (climatic conditions). Data show the relationship between stocks contained in tanks versus corrosion rate, and size and location of tanks versus corrosion rate. A corrosion mechanism is considered briefly. Corrosion control includes gas blanketing, inhibitors, breathing systems and protective coatings. Other topics include corrosion below the liquid level, vapor space effects, temperature effects and plate thickness corrosion allowance.

Authors' Abstract

Thompson, P. F. and Lorking, K. F. SOME ASPECTS OF THE CORROSION PROCESSES OF IRON, COPPER AND ALUMINUM IN ETHYLENE GLYCOL COOLANT FLUIDS. *Corrosion 13*, 531-35t (1957) August.

The corrosion potentials of aluminum, iron and copper, the principal metals in coolant systems, were measured in glycol-water solutions. The effect on these metals with the addition of triethanolamine phosphate was studied. Copper ions produced by corrosion of copper are stabilized by triethanolamine phosphate. The copper complex in solution remained stable until it reached iron or aluminum surfaces where it was deposited, causing corrosion.

Authors' Abstract

Sugalski, A. A. and Williams, S. L. MEASUREMENT OF CORROSION PRODUCTS IN HIGH TEMPERATURE, HIGH PRESSURE WATER SYSTEMS. *Corrosion 13*, 572t-74 (1957) September.

The concentration of corrosion products and other impurities which produce undesirable radionuclides must be maintained at extremely low values in the primary coolant systems of nuclear power plants to keep the resulting radioactivity below certain maximum values. In the development of purification systems, it is necessary to measure the impurities concentration and solubility as these exist at the primary coolant temperature. A high efficiency filter for this purpose was developed and data obtained from both radioactive and non-radioactive water systems.

MILLIONS ARE BEING SPENT IN OIL'S SEARCH FOR CORROSION CURBS. *Petrol. Week 19*, 32-54 (1957) July 19.

Corrosion is costing the petroleum industry an estimated $2-billion every year in damage to equipment used in finding, producing, moving, processing, and marketing oil and gas and their byproducts. To combat it is one of the industry's most pressing problems, and nothing startling in methods or techniques appears on the immediate horizon. There will be slow, steady progress through improvements of existing techniques.

Epoxy Resins

Detlefsen, R. J. CHICAGO: EXTERNAL REPAIRS MADE WITH EPOXY RESINS. *Amer. Gas. J. 184* 12-14 (1957) July.

People Gas Light and Coke Company has been conducting experimental work on epoxy resins for the repair of underground facilities. Epoxy resin bell and spigot compound was so promising that this resin is now used for repairs.

High-Temperature Materials

Schuetz, A. E. and Robertson, W. D. HYDROGEN ABSORPTION, EMBRITTLEMENT

AND FRACTURE OF STEEL. *Corrosion 13,* 437t-58t (1957) July.

Results of a four-year research program at the Yale University Metallurgy Dept. are presented with a review of the problems associated with the spontaneous fracture of steel in sour gas condensate wells. This work included a comparison of H_2S embrittlement with that resulting from cathodic H_2 production and a study of the effect of important variables on spontaneous fracture at constant deformation; H_2 absorption and permeability in iron-nickel and effects of applied stress, structure and H_2 concentration on the time to static fracture were studied. Tables and charts and a list of 43 references is included.

THE CLEVELAND HIGH-TEMPERATURE MATERIALS CONFERENCE: A TECHNICAL SUMMARY. *J. Metals 9,* 964-68 (1957) July.

Technical summary of Cleveland High-Temperature Materials Conference, April 1957. Materials attractive for use at 1500° F. in aircraft, missiles, and nuclear reactors were the topic of discussion. Properties of SAP-type materials, status and future of cobalt-base alloys cermets and bonded hard metals, chromium-base alloys for high-temperature applications, and effect of vacuum melting on nickel-base alloys are discussed.

C. L. Tsaros

Metals

Braendel, H. G. CHROME PLATING REDUCES ENGINE RING WEAR. *Pipe Line Ind. 7,* 48-50 (1957) September.

Longer life, better oil control, better blowby control resulting in cleaner lube oil and fewer filter changes are essential factors in the economic operation of pipeline pumping engines. Chrome plating of the compression rings has made ring life of 30,000-40,000 hours possible.

Corruccini, R. J. PROPERTIES OF MATERIALS AT LOW TEMPERATURES. PART 1. *Chem. Eng. Progress 53,* 262-67 (1957) June; PART 2. *Ibid.* 342-46 July; PART 3. *Ibid.* 397-402 August.

Work at the Boulder Lab. on low-temperature data is organized and interpreted in the light of theory, and shows useful estimation procedures derived from theory to fill gaps in the available data.

Mote, M. W. and Jackson, R. J. MAGNESIUM AND ITS ALLOYS. *Materials and Methods 46,* 115-34 (1957) July.

Increased use of magnesium has resulted from new alloys, development of the hot chamber die-casting process, improved finishing systems, and large-scale production of sheet and plant. This is a 20-page manual on the properties, fabrication and uses of the magnesium alloys now commercially available.

THE LOS ANGELES REACTIVE METALS CONFERENCE: A TECHNICAL SUMMARY. *J. Metals 9,* 969-80 (1957) July.

Technical summary of Regional Reactive Metals Conference, Los Angeles, May 1957. Short discussions of metallurgical properties of hafnium, zirconium, titanium, alkali metals, thorium, molybdenum, vanadium, columbium, and the fabrication of reactive metals. C. L. Tsaros

Plastics

Greathouse, W. D. and McGlasson, R. L. PLASTIC PIPING—8 YEARS LATER. *Oil Gas J. 55,* 106-12 (1957) August 12.

This is a guide to intelligent use of plastic pipe in oil-field operations. Three types of currently available materials—extruded plastics, glass-reinforced plastics and plastic coatings are treated, with preferred use, maintenance cost, property deterioration, temperature-strength characteristics, and creep characteristics.

Scheil, M. A., Fratcher, G. E., Henry, S. L. and Uecker, E. H. STEEL FOR CANADIAN PIPELINES. *Mech. Eng. 79,* 853-57 (1957) September.

For the colder regions of Canada, it has become important to determine how pipe performance at -50°F differs from that at ordinary temperatures. This paper reports on burst tests at subzero temperatures, made on commercial pipe of various diameters and wall thicknesses. The pipe performance at hydrostatic burst includes strength, circumferential stretch, type of fracture, and tendency to shatter.

SERVICE EXPERIENCE OF GLASS-REINFORCED PLASTIC TANKS. *Corrosion 13,* 459t, 60 (1957) July.

The fourth in a series of reports on this type of tank. The failure of a glass-polyester tank previously reported is explained and circumferential measurements of 250- and 500-barrel tanks are reported. G. G. Wilson

STRENGTH AND SERVICE CHARACTERISTICS OF GLASS REINFORCED EPOXY OILFIELD PIPE. *Corrosion 13,* 117, 18-20 (1957) September.

Important considerations in evaluating the characteristics of reinforced plastic pipe are reviewed. Fifteen tests used by the writer's company in checking strength and reliability of its product are listed. Resistance of epoxy-glass reinforced plastic pipe versus 26 acids, four alkalis, four gases, 15 salts, 11 solvents and 10 industrial fluids is tabulated. Some data are given on experience, particularly in oil-field service. Author's Abstract

THESE CURVES GIVE FATIGUE PROPERTIES OF REINFORCED PLASTICS. *Materials and Methods 46,* 108-11 (1957) July.

Data showing the effects of design variables on fatigue strength of glass-reinforced plastics laminates include: 1) type of glass reinforcement and resin, 2) moisture, 3) stress concentration, 4) elevated temperature, and 5) mean stress level. Materials used and test procedures are discussed.

"Super" Glass

Taylor, D. M. FROM OUT OF THE LABORATORY COMES A NEW SUPER GLASS. *Petrol Eng. 29,* B78, 80, 81 (1957) August.

A "super glass" has been invented which is lighter than aluminum, harder than high carbon steels, and has a flexural strength above 30,000 psi. Mechanical, electrical, thermal, chemical and optical properties are listed. The cost and possible applications are discussed.

13. NEW BOOKS

(C. A. Simms, Librarian)

Coal Petrography

Parks, B. C. and O'Donnell, H. J. PETROGRAPHY OF AMERICAN COALS. Bureau of Mines. Bulletin 550. G.P.O. Washington, D. C. 1956.

A compilation of all available petrographic information, this report gives tabulated data of 217 samples of various American coals investigated in the Bureau of Mines Coal Petrography Laboratory. It also includes chemical analyses, results of incidental tests and determinations, data from certain research studies of selected petrographic samples of the coals, and geological and mine information on source of samples, with descriptive vertical sections of the coal beds sampled. Authors' Abstract

Metallurgy

Burton, M. S. APPLIED METALLURGY FOR ENGINEERS. New York: McGraw Hill Book Co., Inc. (1957).

This college-level book for non-metallurgy engineers treats the subjects under the following divisions; nature of metals, methods of metallurgical examination; mechanical testings; and phases, phase changes and phase diagrams. The principles of heat treatment discussion include the iron-carbon diagram and forms, equilibrium and non-equilibrium cooling, time-temperature-transformation curves and hardening and annealing but with very little on nonferrous metals. The fabrication industry and the industrial gas engineer will be interested in the latter. Individual chapters are devoted to foundry metallurgy and technology, coating, molding, theory of metal-working, cold and hot working, bonding, welding brazing and soldering, and cutting. The volume presents many photographs, diagrams, graphs and photomicrographs.

Petroleum Supply

Spangler, M. B. NEW TECHNOLOGY AND THE SUPPLY OF PETROLEUM. (University of Chicago. Program of Education and Research in Planning, Research Paper No. 2). Yorktown Heights, N. Y.: The Author (1957).

A study centered on the problem of estimating the contributions of new technology to the supply of petroleum. Technological changes have made such important contributions toward reducing the cost of our remaining oil reserves that only limited additional planning is required to meet our resource needs.

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Russian Translations

English translations of Russian articles abstracted herein can be supplied by arrangement with the abstractor.

Periodicals Abstracted for GAS ABSTRACTS

Air Conditioning, Heating and Ventilating
Air Pollution Association, Journal
American Chemical Society, Journal
American Gas Association Monthly
American Gas Journal
American Institute of Chemical Engineers, Journal
American Petroleum Institute Quarterly
American Society for Testing Materials Bulletin
American Society of Mechanical Engineers. Transactions
Analytical Chemistry
Appliance Manufacturer
Association for Computing Machinery, Journal
Australian Journal of Applied Science
Australian Journal of Chemistry

Bituminous Coal Research Reports
Brennstoff-Chemie
British Coal Utilization Research Association Monthly Bulletin and Quarterly Gazette
Butane-Propane News

California Oil World
Canadian Chemical Processing
Canadian Gas Journal
Canadian Journal of Chemistry
Canadian Journal of Physics
Canadian Journal of Technology
Chemical and Engineering News
Chemical and Process Engineering
Chemical Engineering
Chemical Engineering Costs Quarterly
Chemical Engineering Progress
Chemical Engineering Science
Chemical Processing
Chemical Reviews
Chemical Society (London) Journal
Chemical Week
Chemistry and Industry
Coal Heat
Coke and Gas
Combustion
Combustion and Flame
Computers and Automation
Construction Methods and Equipment
Corrosion
Corrosion Technology

Drilling

Engineers' Digest
Erdöl und Kohle

Faraday Society. Transactions
Fuel
Fuel Efficiency
Fueloil and Oil Heat

Gas
Gas Age
Gas and Oil Power
Gas Council (British) Publications
Gas Heat
Gas Journal
Gas Times
Gas und Wasserfach
Gas World

Heating, Piping and Air Conditioning

Independent Petroleum Association of America Monthly
Industrial and Engineering Chemistry
Industrial Finishing
Industrial Gas (American)
Industrial Gas (British)
Industrial Heating
Institute of Fuel (British). Journal
Institute of Gas Technology Publications
Institute of Petroleum (British). Journal
Institution of Gas Engineers. Bulletins, Communications and Transactions
Instruments

Jet Propulsion
Journal des Usines a Gaz
Journal of Applied Chemistry
Journal of Applied Mechanics
Journal of Applied Physics
Journal of Chemical Physics
Journal of Metals
Journal of Organic Chemistry
Journal of Petroleum Technology
Journal of Physical Chemistry
Journal of Research (National Bureau of Standards)
Journal of Scientific Instruments

Laboratory Practice
LP-Gas
Lubrication

Materials and Methods
Mathematical Aids
Mechanical Engineering
Metal Progress
Mining Engineering

National Advisory Committee for Aeronautics, Reports
National Fire Protection Association Quarterly
National Gas Bulletin of Australia
National Petroleum News
Nuclear Science and Engineering
Nucleonics

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Petroleum
Petroleum Engineer
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Physics and Chemistry of Solids
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Radiation Applications
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Science
Svenska Gasverksföreningens Månadsblad
U.S. Bureau of Mines, Bulletins, Information Circulars, Reports of Investigations and Technical Papers
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THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY